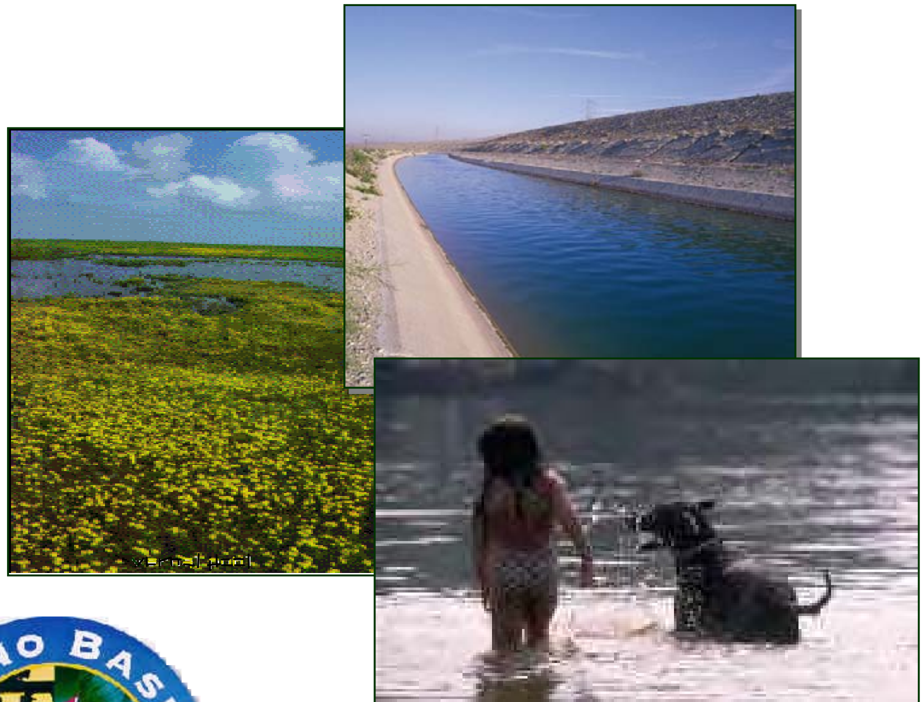
Optimum Basin Management Program



Recharge Master Plan
Phase II Report

Prepared for

Chino Basin Watermaster

August 2001

WE WILDERMUTH ENVIRONMENTAL, INC.

BLACK & VEATCH Corporation

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Chino Basin Watermaster (Watermaster) and the Stakeholders of the Chino Optimum Basin Management Program (OBMP) have authorized Black & Veatch and Wildermuth Environmental, Inc., to develop an implementation plan to increase groundwater recharge within the Chino Basin (Basin).

This Recharge Master Plan Phase II Report (Phase II Report) builds upon a series of local collaborative efforts, documented in part in the Chino Basin Recharge Master Plan Phase I Final Report [Ref. 1] and the OBMP Phase I Report [Ref. 2]. Both Phase I Reports state the need for a comprehensive recharge program and identify existing recharge basins and potential new recharge sites.

This Phase II Report takes the next step by recommending improvements to facilities and potential new sites identified in the Phase I Reports. Additional opportunities are also identified, including innovative concepts for storm water retention.

The Santa Ana Watershed is the fastest growing watershed in the United States (current population of 4.5 million is projected to increase by 2 million over the next 25 years). In the Chino Basin alone, the current population of 1.2 million is estimated to reach 1.6 million or more by 2020. As people, industry, and business move to the area, the demand for water will steadily rise. Figure ES-1 shows the Chino Basin and the major groundwater recharge facilities within the Basin. Figure ES-2 shows population and housing projections for the next 20 years. Figure ES-2 also shows the projected water demand over the same time period. (Estimates are from the June 29, 2000 Chino Basin Peace Agreement Exhibit B, Implementation Plan.) Conservation and efficient use of the Basin's water supply is paramount to meet these growing future demands.

Need for Recharge Capacity

The San Bernardino County Flood Control District (SBCFCD), Riverside County Flood Control and Water Conservation District (RCFCWCD), and the US Army Corps of Engineers (USACE) have constructed flood control projects that efficiently capture and convey storm water to the Santa Ana River.

Figure ES-3 is a double mass curve plot of precipitation at the San Bernardino Hospital versus storm water discharge at below Prado Dam. Note that the slope of the double mass curve after October 1977 is much steeper than prior to October 1977. The change in curvature means that significant changes occurred in the precipitation – runoff relationship. These changes were caused by an increase in imperviousness in the watershed due to urbanization and associated improvements in drainage systems. Figure ES-4 is a double mass curve plot of precipitation at the San Bernardino Hospital versus storm water discharge from the watershed between Riverside Narrows and Prado dam and includes the Chino Basin, Temescal, and part of the City of Riverside. The relationship of storm water discharge and precipitation in Figure ES-4 is similar to that shown on Figure ES-3 with Chino Basin representing about 75 percent of the storm water produced between Riverside Narrows and Prado Dam. The volume of storm water not captured for recharge in the Basin during the period October 1977 and September 1999 averaged about 41,000 acre-feet per year (acre-ft/yr) and ranges from a low of 2,000 acre-ft/yr to a high of about 174,000 acre-ft/yr. The volume of storm water produced in the Basin will increase substantially in the future as the remaining undeveloped and agricultural land uses are converted to developed uses.

Increasing the yield of the Basin by increasing the capture of new storm water discharge will improve ambient groundwater quality, improve surface water quality in the Santa Ana River and its tributaries, and increase the assimilative capacity of the Basin. Increasing the capture of new storm water will reduce the cost of mitigation requirements for recharge of recycled water. The volume of new storm water recharge will have a dramatic impact on the future cost of recycled water recharge. New storm water recharge will be used to offset part of the replenishment obligation of the desalters that are being constructed as part of the OBMP.

Pursuant to the Phase I Reports and the Peace Agreement, Watermaster will assure there is enough physical recharge capacity to meet its replenishment obligation under the Judgment. The estimated annual replenishment obligation for the Basin for ultimate conditions is about 75,000 acre-ft/yr. The ultimate physical recharge requirement is equal to the ultimate replenishment obligation (about 75,000 acre-ft/yr) minus the under production (about 31,000 acre-ft/yr) and is equal to about 44,000 acre-ft/yr. The OBMP assumes that imported water will be available from Metropolitan Water District of Southern California (Metropolitan) seven out of ten years. Therefore, Watermaster will need an annual physical recharge capacity of about 63,000 acre-ft/yr (63,000-44,000/0.7).

Methodology

The main tasks of this investigation were: to estimate the potential increase in groundwater recharge using the most recent information, to describe the improvements in facilities and operations necessary to maximize recharge, and to identify the institutional arrangements that may be necessary to implement the recharge master plan. The analysis targeted several existing and proposed stormwater retention, debris, and conservation basins that were identified in the Phase I Reports. Black & Veatch performed a system inventory including site reconnaissance and data review for the basins. Wildermuth Environmental, Inc., provided updated storm water and recharge modeling simulations to identify the range of potential future recharge capacity. In addition to existing and proposed basins, the analysis assessed the potential for new areas for groundwater recharge, including developing new recharge basins, on-site recharge, and groundwater injection. Figure ES-5 presents the locations of new potential recharge areas.

The physical ability to recharge water from three potential water sources was assessed: storm water, recycled water, and imported water. The assessment of average annual storm water recharge capacity estimates that the ultimate (Year 2020) capacity ranges between 18,790 and 23,700 acre-ft/yr.

The potential recycled water recharge capacity that could be developed through the implementation plan presented in this Phase II Report ranges from 18,790 to 23,700 acre-ft/yr. It has been assumed that the long-term average recharge of recycled water will be the same as storm water and will not exceed 20 percent of the total recharge in any recharge basin. This assumption is conservative and is based on the current California Department of Health Services (DHS) guidelines for recycled water recharge projects. As described in Chapter 2, the Inland Empire Utility Agency (IEUA) is conducting a Recycled Water System Feasibility Study. The recycled water projects described in this Phase II Report will be incorporated into the IEUA program and will move forward on a slightly different schedule than the storm water and imported water recharge facilities improvement projects.

The potential imported water recharge capacity that could be developed through the implementation plan presented in this Phase II Report ranges from 81,800 to 122,100 acre-ft/yr. The source of imported water used for recharge in the Basin was assumed to be the State Water Project (SWP). The combined potential recycled and imported water recharge capacity ranges from 100,590 to 145,800 acre-ft/yr. Based on current and future pumping, the replenishment obligation is estimated to be about 63,000 acre-ft/yr. Thus, excess recharge capacity could be available. If this capacity is fully developed, it will provide greater flexibility in managing recharge in general (e.g., maintaining hydrologic balance), and could be used for conjunctive use.

Assessment of Recharge Facilities

Based on the site reconnaissance results and the analysis of available water sources, Black & Veatch developed preliminary improvements needed to increase the recharge capabilities of the existing recharge basins. Figure ES-1 shows the existing recharge basins as well as other major water facilities in the area. The current status of these basins ranges from fully operational conservation facilities to inoperable or out-of-service facilities. These basins include: Brooks Basin, Montclair Basins, Seventh and Eighth Street Basins, Upland Basin, Ely Basins, Etiwanda Spreading Basins, Hickory Basin, Lower Day Basin, San Sevaine Basins, Turner Basins, Victoria Basin, Banana Basin, Declez Basin, Etiwanda Conservation Ponds, Jurupa Basin, and Wineville Basin. New basins include the College Height Basins and RP-3 Basin. Improvements to increase storm water recharge consist mainly of earthwork to improve percolation and increase basin storage capacity, new basin inlets or modification to existing inlets, and new outlets or modifications to basin outlets. Improvements for recycled water recharge include the construction of inlet structures, conveyance facilities, and turnouts from the proposed IEUA Regional Recycled Water Distribution System. Improvements for imported water recharge include the construction of inlet structures, conveyance facilities, and turnouts from Metropolitan's Foothill Feeder, also referred to as the Rialto Pipeline. To the extent possible, use of existing facilities was assumed. Capital cost opinions and present value cost opinions were developed for each basin.

Alternative Recharge Opportunities

IEUA and Watermaster are working with the Rocky Mountain Institute to develop local onsite and other alternative recharge opportunities for inclusion in the Recharge Master Plan. As with recharge basins, these alternative recharge opportunities will assist local communities in implementing future Total Maximum Daily Loads (TMDLs) and in compliance with NPDES permits and with future storm water management requirements such as those adopted by the Los Angeles Regional Water Quality Control Board – Standard Urban Storm Water Mitigation Plan. These alternative recharge opportunities are currently being developed and will be included in a supplement to this Phase II Report later in 2001.

Implementation Plan

The Implementation Plan addresses storm water recharge and imported water recharge facilities improvements. To facilitate the implementation of these improvements, a Chino Basin Recharge Implementation Committee was established. The committee includes representatives from the

Watermaster, IEUA, SBCFCD, and CBWCD. Table ES-1 presents a summary of the improvements proposed for each recharge facility. Table ES-2 summarizes the management zone, recharge capacity, and estimated capital cost for the recharge basin improvements described in this Phase II Report.

Table ES-1
Summary of Proposed Basin Improvements for
Storm Water and Imported Water Recharge

Recharge Basin	Proposed Improvement							
	Expand/Construct New Metropolitan Turnout	Construct Pipeline from Turnout to Creek/Channel	Construct Channel Diversion Structure	Construct Pipeline from Diversion Structure to Basin	Modify/Construct Inlet/Outlet Works	Modify/Provide SCADA Monitoring	Optimize Basin Geometry	Construct Facilities for Conveyance Between Two Basins
Brooks Street Basin			☯	☯	☯			
Montclair Basins							☯	
7th & 8th Street Basins	☯ (1)	☯			☯	☯	☯	
Upland Basin					☯		☯	☯ (7)
Ely Basins	☯	☯			☯	☯		
Etiwanda Spreading Basins	☯ (2)							
Hickory Basin	☯ (3)	☯	☯		☯		☯	☯ (8)
Lower Day Basin	☯ (4)	☯			☯			
San Sevaine Basin Nos. 1-3	☯ (5)							
San Sevaine Basin Nos. 4 and 5	☯				☯		☯	
Turner Basin No. 1	☯ (6)		☯		☯		☯	
Turner Basin Nos. 2, 3, and 4	☯		☯		☯		☯	
Victoria Basin	☯				☯			
Banana Basin	☯	☯	☯		☯		☯	☯
Declez Basin	☯	☯			☯			
Etiwanda Conservation Ponds	☯				☯		☯	
Jurupa Basin	☯	☯			☯			☯ (9)
Wineville Basin	☯	☯			☯	☯	☯	
College Heights Basin	☯		☯		☯		☯	☯
RP3 Recharge Basins	☯	☯	☯		☯		☯	☯

Notes:
(1) Shared with Ely Basin.
(2) Shared with Victoria Basin and Etiwanda Conservation Ponds.
(3) Shared with Banana, Declez, Jurupa, and RP-3 Basins.
(4) Shared with Wineville Basin.
(5) Shared with San Sevaine Basin Nos. 4 and 5.
(6) Shared with Turner Basin Nos. 2, 3, and 4.
(7) Facilities provided for conveyance with College Heights Basin.
(8) Facilities provided for conveyance with Banana Basin.
(9) Facilities provided for conveyance with RP-3 Basin.

Table ES-2
Recharge Capacity and Costs

Recharge Facility	Mgmt. Zone	Potential Recharge Capacity (acre-ft/yr) [1]									Project Capital Cost
		Storm Water			Imported Water			Recycled Water [2]			
Existing Basins											
Brooks Street Basin	1	1,600	to	1,800	2,200	to	3,300	1,600	to	1,800	$1,466,000
Montclair Basin Nos. 1-4	1	2,100	to	2,100	10,300	to	15,300	2,100	to	2,100	$1,858,000
Seventh and Eighth Street Basin	1	1,100	to	1,600	1,400	to	2,100	1,100	to	1,600	$2,048,000
Upland Basin	1	1,000	to	1,000	5,800	to	8,700	1,000	to	1,000	$1,205,000
Ely Basins	2	2,300	to	2,800	3,400	to	5,100	2,300	to	2,800	$2,686,000
Etiwanda Spreading Basins	2	1,200	to	1,700	5,800	to	8,600	1,200	to	1,700	$523,000
Hickory Basin	2	600	to	900	3,100	to	4,600	600	to	900	$2,340,000
Lower Day Creek Basin	2	400	to	500	2,800	to	4,200	400	to	500	$2,540,000
San Sevaine Basin Nos. 1-3	2	1,420	to	1,700	15,200	to	22,700	1,420	to	1,700	$783,000
San Sevaine Basin Nos. 4 and 5	2	400	to	500	5,400	to	8,100	400	to	500	$4,123,000
Turner Basin No. 1	2	700	to	900	600	to	900	700	to	900	$3,995,000
Turner Basin Nos. 2, 3, and 4	2	1,300	to	1,800	2,300	to	3,400	1,300	to	1,800	$3,364,000
Victoria Basin	2	800	to	1,000	3,400	to	5,100	800	to	1,000	$589,000
Banana Basin	3	600	to	800	2,400	to	3,600	600	to	800	$3,134,000
Declez Basin	3	200	to	300	1,200	to	1,800	200	to	300	$2,049,000
Etiwanda Conservation Ponds	3	800	to	1,100	3,900	to	5,800	800	to	1,100	$3,118,000
Jurupa Basin	3	500	to	700	800	to	1,200	500	to	700	$1,700,000
Wineville Basin	3	500	to	700	700	to	1,100	500	to	700	$2,884,000
New Basins											
College Heights Basin	1	70	to	100	5,300	to	7,900	70	to	100	$5,625,000
RP-3 Basins	3	1,200	to	1,700	5,800	to	8,600	1,200	to	1,700	$5,595,000
Total	--	18,790	to	23,700	81,800	to	122,100	18,790	to	23,700	$51,625,000

Notes:

(1) Based on optimum recharge operations. Low estimate assumes a recycled water contribution of 20% and the high estimate assumes a recycled water contribution of 50%

(2) It has been assumed that the average annual recharge of recycled water will be the same as storm water. The recycled water recharge capacity is currently under evaluation by IEUA in it's Recycled Water System Feasibility Study.

Several institutional arrangements will need to be developed before the proposed improvements are constructed. Currently, CEQA compliance coordination has been initiated for the proposed improvements outlined in this Phase II Report. It is anticipated that CEQA coordination will be completed within the next two months. Long-term operation/maintenance agreements between Watermaster, IEUA, SBCFCD, and CBWCD are also needed to insure maximum operational efficiency.

Design of the improvements will commence with completion of the environmental work and should be completed by April 2002. It is currently planned to design all physical improvements, such as inlets, outlets, monitoring wells, and associated piping. The excavation elements may be excluded from some of the site work to allow the removal of material by third-party contractors, who would pay to remove and sell material from the basins. This approach would be driven by the market needs for material and could extend completion of some work. However, significant cost savings would result.

The length of construction for all of the improvements (except for various excavations using third-party contractors) is estimated to be approximately 14 months. The construction period is somewhat extended because of the need to limit construction activities to between April 15th – October 15th to avoid potential conflict with essential flood control operations.

Continuous monitoring of the facilities will commence upon completion of the construction phase. It is anticipated that the improvements will be constructed by June 30, 2003. The preliminary implementation schedule is presented on Figure ES-6.

INSERT FIGURE ES-1

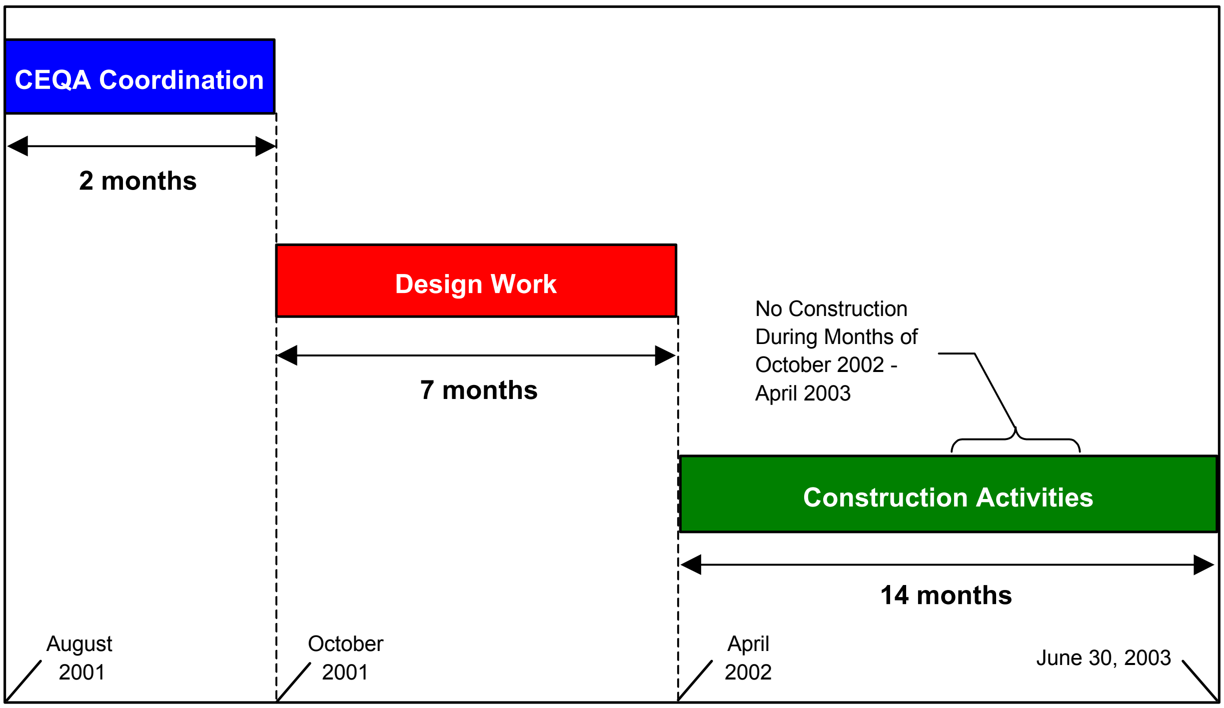
INSERT FIGURE ES-2

INSERT FIGURE ES-3

INSERT FIGURE ES-4

INSERT FIGURE ES-5

Figure ES-6
Preliminary Implementation Schedule



1.0 INTRODUCTION

1.1 Overview

This report presents Phase II of the Chino Basin Recharge Master Plan. The project purpose and background information on the Basin and the OBMP are discussed below. The methodology for assessing future groundwater recharge potential is also described. As noted in the References subsection at the end of this chapter, this Master Plan builds upon several previous studies and reports.

1.2 Purpose

The purpose of Phase II of the Master Plan is to update and expand opportunities for groundwater recharge within the Basin. This Phase II Report identifies storm water and imported water recharge facilities improvements that can be implemented immediately. Also identified are recycled water recharge facilities improvements that can be implemented as part of IEUA's recycled water program.

1.3 Background

The Chino Basin consists of about 235 square miles of the upper Santa Ana River watershed. The Basin is bounded by Cucamonga Basin and the San Gabriel Mountains on the north; the Rialto-Colton Basin on the northeast; the chain of Jurupa, Pedley, and La Sierra Hills on the southeast; the Temescal Basin on the south; Chino Hills and Puente Hills on the southwest; and San Jose Hills and the Pomona and Claremont Basins on the northwest. The Basin lies within the Counties of San Bernardino, Riverside, and Los Angeles.

The Basin is an integral part of the regional and statewide water supply system. One of the largest groundwater basins in Southern California, the Basin contains about 5,000,000 acre-feet (acre-ft) of water and has an unused storage capacity of about 1,000,000 acre-ft. Cities and other water supply entities produce groundwater for all or part of their municipal and industrial supplies. Agricultural users also produce groundwater from the Basin, but irrigated agriculture has declined substantially in recent years and is projected to be almost gone by 2020 [Ref. 1].

The boundary of the Chino Basin is legally defined in the Judgment in the case of Chino Basin Municipal Water District vs. the City of Chino et al. (SBSC Case No. RCV 51010), issued in 1978. Since that time, the Basin has been operated as described in the Judgment through a courtappointed Watermaster. The OBMP is being implemented pursuant to the Judgment and several more recent court rulings.

1.3.1 Goals of the OBMP Water Supply Plan

The Court officially accepted the scope of work to develop the OBMP on November 5, 1998. The OBMP Phase 1 Report was completed August 19, 1999 [Ref. 1]. Table 1-1 provides a summary of OBMP goals and lists activities necessary to meet the goals. A more thorough description of goals and actions items is found in Table 3-8 of Ref. 1.

The goals and action items will be developed and implemented through nine Program Elements: (1) Comprehensive Monitoring Program, (2) Comprehensive Recharge Program, (3) Water Supply Plan for the Impaired Areas of the Basin, (4) Comprehensive Groundwater Management Plans for Management Zones as needed, (5) Regional Supplemental Water Program, (6) Cooperative Programs To Improve Basin Management, (7) Salt Management Program, (8) Groundwater Storage Management Program, and (9) Conjunctive-Use Programs.

This Phase II Master Plan is a component of Program Element 2: Develop and Implement a Comprehensive Recharge Program.

1.3.2 OBMP Groundwater Recharge Component

Ref. 1 and Ref. 2, respectively, state the need for a comprehensive recharge program and present a proposed scope of work. Scope of work tasks conducted as part of this Phase II Study include meetings with appropriate agencies, development of a financing concept, review of new hydrogeologic and facilities information, evaluation of new computer simulations of runoff and recharge, identification of existing and proposed recharge facilities that merit detailed investigation, and a reconnaissance level feasibility investigation of using injection wells for recharge in Management Zone 1. The financial concept subtask will be developed as part of the implementation plan, and the injection well analysis has been deferred. All other subtasks have been completed, and the results are presented in this Report.

Table 1-1
Goals of the OBMP

Goal	Activities Necessary to Meet Goals
Enhance Basin Water Supplies	Enhance Recharge of Storm Water Runoff
	Increase Recharge of Recycled Water
	Develop New Sources of Supplemental Water
	Promote Direct Use of Recycled Water
	Promote Treatment and Use of Contaminated Groundwater
	Reduce Groundwater Outflow
	Re-determine Safe Yield
Protect and Enhance Water Quality	Treat Contaminated Groundwater To Meet Beneficial Uses
	Monitor and Manage the Basin To Reduce Contaminants and To Improve Water Quality
	Manage Salt Accumulation Through Dilution or Blending and the Export of Salt
	Address Problems Posed by Specific Contaminants
Enhance Management of the Basin	Develop Policies and Procedures That Encourage Stable, Creative, and Fair Water Resources Management in the Basin
	Optimize Use of Local Groundwater Storage
	Develop and/or Encourage Production Patterns, Well Fields, Treatment and Water Transmission Facilities, and Alternative Water Supply Sources To Ensure Maximum and Equitable Availability of Groundwater and To Minimize Land Subsidence
	Develop Conjunctive-Use Programs with Others To Optimize Use of the Chino Basin for In-Basin Producers and the People of California
Equitably Finance the OBMP	Identify an Equitable Approach To Spread the Cost of OBMP Implementation
	Identify Ways To Recover Value from Utilizing Basin Assets

1.4 Methodology

As part of this project, Black & Veatch performed a system inventory and data review, including site reconnaissance. Wildermuth Environmental, Inc., provided data on existing basins and potential future recharge capacity and updated basin modeling simulations. Black & Veatch then developed potential improvements to existing basins and reviewed development of new recharge areas. The consultant team, the Watermaster, and the Basin Stakeholders worked together to develop the implementation plan described in this Report.

1.4.1 System Inventory and Data Review

To evaluate the existing system of water conservation and flood control basins, Black & Veatch conducted site visits, assisted by Watermaster staff. Photographs were taken, and care was taken to note the location and condition of each inlet and outlet structure, as well as the condition of the basin itself. The most recent plan and profile reference drawings were collected from SBCFCD. Wildermuth Environmental, Inc., provided data on current ownership, surface area, percolation rate, and potential increase in recharge capacity.

1.4.2 Modeling

Simulation models were used to estimate potential groundwater recharge. The model estimates all the inflow and outflow terms of the continuity equation for each basin using 41 years of historical data. Storm water inflows into each basin are calculated from these estimates and combined with potential imported water and recycled water inflows. Basin hydraulics for proposed improvements and improved operating procedures were used to develop preliminary estimates of potential groundwater recharge at each basin. Following implementation of the proposed improvements, a more accurate interpretation of recharge capacity will be realized.

1.4.3 Development of Implementation Plan

Existing basins were evaluated to determine their future recharge potential. The availability of storm water, recycled water, and imported water was assessed, and preliminary plans and facilities improvements were developed to increase groundwater recharge. For each basin, the capital cost of improvements was estimated. Also reviewed in lesser detail were areas for new recharge facilities including development of new basins, on-site recharge, and injection wells. Through meetings with the Watermaster, Basin Stakeholders and others, it was agreed to move forward immediately with storm water recharge and imported water recharge facilities improvements. It was also agreed that recycled water recharge facilities improvements would move forward under the auspices of IEUA.

1.5 Abbreviations/Acronyms

The following abbreviations/acronyms are used in this report:

ac	acre
acre-ft	acre-feet
acre-ft/yr	acre-feet per year
Basin	Chino Basin
ft/day	feet per day
CBWCD	Chino Basin Water Conservation District
CDFM	cumulative departure from mean
CIM	State of California Institution for Men
CRA	Colorado River Aqueduct
DHS	California Department of Health Services
DWR	California Department of Water Resources
g/L	grams per liter
gpm	gallons per minute
IEUA	Inland Empire Utility Agency
Metropolitan	Metropolitan Water District of Southern California
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
OBMP	Optimum Basin Management Program
PEIR	Program Environmental Impact Report
PGRRP	planned groundwater recharge reuse projects
Phase II Report	Chino Basin OBMP Recharge Master Plan Phase II Report
RCFCWCD	Riverside County Flood Control and Water Conservation District
RWC	recycled water contribution
RWQCB	Regional Water Quality Control Board
SARWQCB	Santa Ana Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Project Authority
SBCFCD	San Bernardino County Flood Control District
SBVMWD	San Bernardino Valley Municipal Water District
SWP	State Water Project
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
USACE	US Army Corps of Engineers
Watermaster	Chino Basin Watermaster

1.6 References

Reference 1: Mark J. Wildermuth, Water Resources Engineer, Chino Basin Recharge Master Plan, Phase 1 Final Report, prepared for Chino Basin Water Conservation District and Chino Basin Watermaster, January 1998.

Reference 2: Wildermuth Environmental, Inc, Optimum Basin Management Program Phase 1 Report, prepared for Chino Basin Watermaster, August 19, 1999.

Reference 3: Mark J. Wildermuth, Final Task 2.2 and 2.3 Report, Describe Watershed Hydrology and Identify Current TDS and TIN Inflows to the Watershed, prepared 1997.

2.0 ISSUES AFFECTING GROUNDWATER RECHARGE

2.1 Overview

To appreciate the need for additional groundwater recharge, an understanding of the geology, groundwater flow system, and potential water demand in the Chino Basin is important. This section briefly reviews Basin geology, flow systems, the groundwater management zones, current and projected water demands, and the need for artificial recharge. The three sources of water available for groundwater recharge are also discussed: storm water, recycled water, and imported water.

2.2 Chino Basin Geology

Chino Basin was formed when eroded sediments from the San Gabriel Mountains, the Chino Hills, Puente Hills, and the San Bernardino Mountains filled a structural depression. The formation of the Basin is described in detail in the Final Task 2.2 and 2.3 Report, issued in 1997 [Ref. 3]. The bottom of the Basin – the effective base of the freshwater aquifer – consists of impermeable sedimentary and igneous rocks. The base of the aquifer is overlain by older alluvium of the Pleistocene period followed by younger alluvium of the Holocene period.

The younger alluvium varies in thickness from over 100 feet near the mountains to just a few feet thick south of Interstate 10 and generally covers most of the northern half of the Basin in undisturbed areas. The younger alluvium is not saturated and thus does not yield water directly to wells. Water percolates readily in the younger alluvium, and most of the large spreading basins are located in the younger alluvium. The older alluvium varies in thickness from about 200 feet thick near the southwestern end of the Basin to over 1,100 feet thick southwest of Fontana and averages about 500 feet thick throughout the Basin. Well capacities range between 500 and 1,500 gallons per minute (gpm). Well capacities exceeding 1,000 gpm are common, with some modern production wells test-pumped at over 4,000 gpm (e.g., Ontario Wells 30 and 31 in southeastern Ontario). In the southern part of the Basin, where sediments tend to be more clayey, wells generally yield 100 to 1,000 gpm.

Faults are one of the principal agents in the development of the landscape and restriction of groundwater flow in the Basin. The Basin is bounded by major fault systems along which the mountains and hills have been uplifted. The location of fault and groundwater barriers, and displacements in the effective base of the aquifer at faults, are shown on Figure 2-1. The faults and groundwater barriers are significant in that they define the external boundaries of the Basin and influence the magnitude and direction of groundwater flow near the boundaries.

2.3 Groundwater Management Zones

The Chino Basin has been hydrologically subdivided into at least five groundwater zones or systems. Figure 2-2 is a groundwater elevation contour map for fall of 1997. Figure 2-3 shows the location of the five groundwater management zones. Each groundwater zone has a unique hydrology, and water resource management activities that occur in each zone have little or no impact on the other zones. Each groundwater system can be considered a management zone. These management zones can be subdivided further if necessary to define and manage flow systems at a finer scale. These management zones are used to characterize the groundwater level, storage, production, and water quality conditions.

2.3.1 Management Zone 1

Management Zone 1 is bounded on the southwest by the Chino and Puente Hills; on the northwest by the San Jose fault that separates Chino Basin from the Pomona and Claremont Heights Basins; on the north by an unnamed non-echelon fault system that is associated with the Cucamonga and Red Hill faults and that separates the Chino Basin from the Cucamonga Basin; and on the east by a line that stretches from the southern most edge of the Red Hill fault to Prado Dam.

Groundwater in Management Zone 1 flows generally south with some localized flows to the west in response to groundwater production. Sources of water to Management Zone 1 include direct percolation of precipitation, returns from irrigation, recharge of storm flows and imported water in spreading basins, and subsurface inflow from the Pomona, Claremont Heights, and Cucamonga Basins. Discharge is through groundwater production and through rising groundwater in Chino Creek and the Santa Ana River.

The following recharge basins are located in Management Zone 1: Brooks, Montclair 1-4, Seventh and Eighth Street, and Upland.

2.3.2 Management Zone 2

Management Zone 2 is bounded on the west by Management Zone 1; on the north by the Red Hill fault that separates the Chino Basin from the Cucamonga Basin; on the northeast by a segment of the Rialto-Colton fault; and on the east by a segment of Barrier J and a line extending from Barrier J in a southwesterly direction to a point of convergence with other management zone boundaries near Prado Dam.

Groundwater in Management Zone 2 flows generally in a southwesterly direction in the northern half of the management zone and then due south in the southern half of the zone. Sources of water to Management Zone 2 include direct percolation of precipitation, returns from irrigation, recharge of storm flows and imported water in spreading basins, and subsurface inflow from the part of the Rialto Basin northwest of Barrier J and the Cucamonga Basin. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Reservoir area.

The following recharge basins are located in Management Zone 2: Ely 1-3; Etiwanda Spreading Basins; Grove; Hickory; Lower Cucamonga and Chris, Lower Day, San Sevaine Nos. 1-3, San Sevaine Nos. 4 and 5, Turner No. 1, Turner Nos. 2, 3, and 4, Turner Nos. 5, 8, and 9, and Victoria. In addition to these basins, the Etiwanda Debris Basin is being constructed by SBCFCD. The Lower Cucamonga and Chris Basins are not being used for recharge due to poor soil conditions. Turner Basin No. 5, 8, and 9 are being filled for recreation. Some of the Etiwanda Spreading Basins may be converted to a habitat area, and the lower part of this area will be converted into the proposed Etiwanda Debris Basin.

2.3.3 Management Zone 3

Management Zone 3 is bounded on the west by Management Zone 2; on the northeast by the Rialto-Colton fault that separates the Chino Basin from the Rialto Basin; and on the southeast by the Bloomington divide, Jurupa Hills, and Management Zones 4 and 5. A southwesterly line from Jurupa Hills to Prado Dam represents the boundary between Management Zones 3 and Management Zones 4 and 5.

Groundwater in Management Zone 3 flows generally in a southwesterly direction. Sources of water to Management Zone 3 include direct percolation of precipitation, returns from irrigation, and subsurface inflow from the part of the Rialto Basin southeast of Barrier J. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Reservoir area.

The following recharge basins are located in Management Zone 3: Banana, Declez, Etiwanda Conservation Ponds, Jurupa, and Wineville.

2.3.4 Management Zone 4

Management Zone 4 is bounded on the west by Management Zone 3; on the north by the Jurupa Hills, on the southeast by the Pedley Hills; and on the south by Management Zone 5.

Groundwater in Management Zone 4 flows west. Sources of water to Management Zone 4 include direct percolation of precipitation and returns from irrigation. Discharge is through groundwater production.

2.3.5 Management Zone 5

Management Zone 5 is bounded on the north and west by Management Zones 3 and 4, Prado Dam; on the east by the Riverside Narrows; and on the south by the La Sierra area and Temescal Basin.

Sources of water to Management Zone 5 include streambed percolation in the Santa Ana River, direct percolation of precipitation, returns from irrigation, and subsurface inflow from the Temescal Basin. Discharge is through groundwater production, consumptive use by phreatophytes (deep-rooted plant that obtains water from a permanent ground supply or from the water table), rising groundwater in the Prado Reservoir area, and potentially other locations on the Santa Ana depending on climate and season.

2.3.6 Basins Included in the Phase II Master Plan

The near surface sediments in Management Zones 4 and 5 are not generally conducive to recharge by surface spreading. Recharge in these management zones without a strategically placed commensurate increase in production could cause an increase in groundwater outflow to the Santa Ana River. This groundwater outflow would defeat the purpose of the recharge and cause degradation of water quality in the River. Therefore, the Phase II Master Plan investigation focused on Management Zones 1, 2, and 3.

2.4 Current and Future Water Demand

The Santa Ana Watershed is the fastest growing watershed in the United States (current population of 4.5 million is projected to increase by 2 million over the next 25 years). In the Chino Basin alone, the current population of 1.2 million is estimated to reach 1.6 million or more by 2020. As people, industry, and business move to the area, the demand for water will steadily rise. Figure 2-4, shows population and housing projections for the next 20 years. The figure also shows the projected water demand over the same time period. (Estimates are from the June 29, 2000 Chino Basin Peace Agreement Exhibit B, Implementation Plan.) Conservation and efficient use of the Basin's water supply are paramount to meet these growing future demands.

2.5 Sources of Groundwater Recharge

Water used for recharge could come from three different sources: storm water, recycled water, and imported water. Storm water is considered the primary source of water for recharge into the basins. Additional sources of possible recharge water include recycled water and imported water. The quantity of recycled water that is permitted to be used for recharge is based on guidelines developed by DHS and is dependent on the volume of storm and imported water that enters the basin.

2.5.1 Storm Water

With the historical and current storm water management strategies, storm water recharge has decreased over time due to land use changes and flood control improvements. Since the 1978 Judgment, irrigated agriculture has declined in the Basin as residential, commercial, and industrial developments have grown. It is projected that, by 2020, virtually none of the land in the Basin will be used for irrigated agriculture. Figure 2-5 shows the changes in land use that have occurred from 1975 to 1993. These land use changes have resulted in declining irrigation returns to groundwater. In addition, SBCFCD, RCFCWCD, and USACE have constructed flood control projects that efficiently capture and convey runoff to the Santa Ana River, virtually eliminating the groundwater recharge that formerly took place in the Chino Basin stream channels and flood plains.

A review of reports from the Santa Ana River Watermaster and investigations used in the development of the 1969 Judgment in *Orange County Water District vs. City of Chino et. al*., (Case No. 117628 – County of Orange) show that there is more storm water being produced in the Santa Ana Watershed in recent time than occurred in the past. Figure 2-6 shows the time history of storm flow for the Santa Ana River below Prado Dam starting in 1920 to 1999). Figure 2-6 also has a plot of the cumulative departure from mean (CDFM) precipitation for the precipitation gage located at the San Bernardino Hospital. Figure 2-6 suggests that the relationship of precipitation to runoff changed significantly around 1977 with much more runoff per unit of precipitation after 1977. To see this, note the positive slope of the CDFM (indicative of a wet period) during the period October 1936 to September 1945. About 64 inches of precipitation occurred above the average of 16.5 inches per year. For the period October 1977 to September 1983, another wet period, there was about 38 inches of precipitation above the mean, but there was much more storm water discharge than occurred during the period 1936 to 1945. A similar observation can be made about the October 1991 to September 1998 period. Table 2-1 presents the relationship between the precipitation above normal and the corresponding storm water produced for the three periods mentioned above.

Table 2-1
Precipitation and Subsequent Storm Water Produced

Period	Period Precipitation Above Normal (inches)	Storm Water Produced for the Period (acre-ft)
10/36 to 9/45	64	570,000
10/77 to 9/83	38	1,098,000
10/92 to 9/98	32	1,186,000

Figure 2-7 is a double mass curve plot of precipitation at the San Bernardino Hospital versus storm water discharge at *below Prado dam*. Note that the slope of the double mass curve after October 1977 is much steeper than prior to October 1977. The change in curvature means that significant changes occurred in the precipitation – runoff relationship. These changes were caused by an increase in imperviousness in the watershed due to urbanization and associated improvements in drainage systems. Figure 2-8 is a double mass curve plot of precipitation at the San Bernardino Hospital versus storm water discharge from the watershed between Riverside Narrows and Prado dam and includes the Chino Basin, Temescal and part of the City of Riverside. The relationship of storm water discharge and precipitation in Figure 2-8 is similar to that shown in Figure 2-7 with Chino Basin representing about 75 percent of the storm water produced between Riverside Narrows and Prado dam. The volume of storm water not captured for recharge in the Chino Basin during the period October 1977 and September 1999 averaged about 41,000 acre-ft/yr and ranges from a low of 2,000 acre-ft/yr to a high of about 174,000 acre-ft/yr. The volume of storm water produced in the Chino Basin will increase substantially in the future as the remaining undeveloped and agricultural land uses are converted to developed uses.

Water harvesting opportunities exist that can be used to offset the yield lost to urbanization and flood control improvements. Water harvesting consists of capturing and recharging new storm water discharges created by urbanization. In the Chino Basin, the best and least expensive way to put this new water to beneficial use is groundwater recharge.

2.5.1.1 Storm Water Runoff and Recharge Modeling

This project involved updates of modeling prepared as part of the 1998 Chino Basin Recharge Master Plan, Phase 1 [Ref. 1]. The estimates were developed as follows.

The recharge that occurs in a spreading basin or channel reach, in any time period can be estimated by solving the continuity equation:

$$\Delta S = I - O$$

Substituting individual inflow and outflow terms:

$$S_{t+1} - S_t = (QI_{t,t+1} - QO_{t,t+1}) * \Delta t + (R_{t,t+1} - P_{t,t+1} - E_{t,t+1}) * A_{t,t+1} * \Delta t$$

Where:

S_t	is the storage in a spreading basin at time *t*
$QI_{t,t+1}$	is rate of runoff into a spreading basin during the period *t* to *t+1*
$QO_{t,t+1}$	is the rate of outflow from a spreading basin during the period *t* to *t+1*
$R_{t,t+1}$	is the precipitation rate that falls on the spreading basin during the period *t* to *t+1*
$P_{t,t+1}$	is the percolation rate from the spreading basin during the period *t* to *t+1*
$E_{t,t+1}$	is the evaporation rate from the water surface in the spreading basin during the period *t* to *t+1*
Δt	duration of the time period *t* to *t+1*
$A_{t,t+1}$	average surface area of the water surface in the spreading basin during the period *t* to *t+1*

The daily percolation rate can be estimated by rearranging terms and solving for Pt,t+1

$$P_{t,t+1} = [S_t - S_{t+1} + (QI_{t,t+1} - QO_{t,t+1}) * \Delta t + (R_{t,t+1} - E_{t,t+1}) * A_{t,t+1} * \Delta t] / A_{t,t+1} * \Delta t$$

Every inflow and outflow term must be measured to estimate the recharge from the continuity equation. This requires flow measuring equipment for each storm drain and diversion into each spreading basin, measuring the discharge from each spreading basin outlet, measuring the water surface elevation in each spreading basin, the precipitation over each spreading basin and the evaporation from each spreading basin. The continuity equation would be solved each day that water is observed in the spreading basin. This approach would yield the volume of water recharged and the percolation rate in units of acre-ft/day and feet per day, respectively. After many years of monitoring the average of annual recharge from each spreading basin could be estimated.

An alternative to monitoring is to use simulation to estimate the terms in the continuity equation, and to estimate annual recharge to the groundwater basin from the overlying facilities. Simulation, as used herein, consists of using a surface flow model (in this case a computer program) with long term historical data to estimate all the inflow and outflow terms contained in the continuity equation. Runoff into each spreading basin is estimated from precipitation, evaporation, soils, land use and drainage system data. Discharge from each spreading basin is estimated based on the outlet works hydraulic characteristics and the water surface elevation in the basin. The model computes daily estimates of inflow, outflow, evaporation, percolation, and storage in each spreading basin. These results are then aggregated to annual estimates and annual recharge statistics are computed. A range in percolation rates is assumed and the average annual recharge is expressed as a range based on the range of percolation rates. A significant advantage of the simulation approach is that the CBWCD and Watermaster will not have to wait 20 or more years to develop enough data on spreading basin performance to estimate the average annual volume of water conserved at CBWCD facilities. The use of models also allows the CBWCD and Watermaster to evaluate the impact on recharge from adding new facilities, modifying existing facilities and operations, and scheduling of maintenance.

2.5.1.2 Simulation Model Description

Two models previously developed by Wildermuth Environmental, Inc., were modified and used: a runoff model and a routing model.

Runoff Model. Daily runoff is estimated for the watershed tributary to each spreading basin using a combination of methods:

> Valley floor areas use a modified version of the method described in *Urban Hydrology for Small Watersheds* (SCS, 1986).
>
> Mountain areas use daily flow data from the USGS, translated to ungaged basins using areal proration.

The mountain areas consist of the watersheds located in the San Gabriel Mountains. The mountain watershed hydrologic processes are similar to valley floor processes with the exceptions that the mountain watersheds can produce sustained base flows, and delayed runoff due to snow pack storage. The measured daily flows from the mountain areas are stationary, that is, their daily flow statistics are not changing over time due to influences from land development or other anthropogenic activities.

By contrast the valley floor areas have been in a constant state of change as the land was converted from natural to agricultural and then to urban uses. There is no stationary stream flow data in the valley floor area that can be used to estimate flow into spreading basins.

Valley floor runoff is estimated in the SCS method from the equation:

$$Q = (P - I_a)^2 / [(P - I_a) + S]$$

Where:

Q	is runoff in inches
P	is the rainfall in inches
S	is the potential maximum retention after runoff begins, and
I_a	is the initial abstraction in inches.

The SCS, through studies of many small watersheds, found that Ia can be approximated by:

$$I_a = 0.2 * S$$

Thus, runoff becomes a function of P, the precipitation, and S, the potential maximum retention. S is related to the soil and cover conditions of a watershed through the Curve Number (CN).

$$S = [1000/CN] - 10$$

CN must be determined from soils and land use data. Soils data are contained in soil surveys prepared by the Department of Agriculture, Soil Conservation Service.

The watershed tributary to each spreading basin is subdivided into hydrologic areas based on the daily flow estimation method used and tributary area. Daily flows for the hydrologic areas tributary to a spreading basin are combined and become the daily inflow to a spreading basin. Some spreading basins have hydraulic limitations on their ability to capture local runoff such as Montclair No. 1, Brooks Street, the Lower Cucamonga basins, Lower Day, and the future Jurupa basin. In these cases, rating curves were used to estimate the daily flow that could be diverted into each basin. The results of the runoff model are written to binary files that are subsequently used as input to the routing model.

Runoff Model Data Requirements. The hydrologic data collected for this study include:

- precipitation data
- daily evaporation data
- daily flow data for mountain watersheds
- SCS soil surveys

- drainage maps
- as-built or design plans for all the flood retention/recharge spreading basins and flood control facilities

Routing Model. The routing model routes the flows between nodes. The routing plan is based on nodal pattern which describes the inflows from the hydrologic areas of the runoff model and the directional flow logic dictated by the flood control channels and retention basins. Flows are routed through the retention and spreading basins using the *modified Puls* reservoir routing scheme described in most hydrology text books (see for example, page 246, *Introduction to Hydrology* (Viessman, Lewis and Knapp, 1989)). The routing model can also estimate the percolation in unlined or partially lined stream channels. The daily, monthly, and annual recharge volumes at spreading basins are computed in the routing model. The results of the routing model are written to output files that are imported into spreadsheets for analysis.

Routing Model Data Requirements. The data required for the routing model include:

- storage-area-elevation and outflow elevation curves for each basin
- depth-percolation rates for each basin
- daily evaporation data
- rating curves for diversions to spreading basins for flow by basins

2.5.1.3 Computational Time Step and Simulation Period

The computational time step or period used in this study is one day. This period was selected because of modeling accuracy issues and data availability. The use of long periods such as weeks, months, seasons or years will lead to gross over-estimates of the recharge at spreading basins. This occurs with long time steps because the estimated inflow is smeared out uniformly over the computational period. Generally, the long period runoff will be less than the long period recharge rate of the spreading basins. This results in over-estimation of actual recharge in the basin. Runoff generally comes from storms that last less than one day and almost always less than two to three days.

Data availability also drives the selection of the time period. Daily flow data is available from the USGS in digital format. Smaller time period are not generally available. The availability of spatially representative, long-term rainfall data in digital format is limited to daily data. Thus, the computational time step of one day was selected as a compromise between computational accuracy and data availability.

The simulation period used in this study is October 1, 1933 to September 30, 1974, a period of 41 years or 14,974 days of continuous simulation. This period was selected to maximize the data available for this study and is the intersection between precipitation data available in greater part of the study area (1934 to 1995) and the daily streamflow data available for the mountain watersheds (1929-1974).

2.5.1.4 Development of Model Data

The data used in the model and sources of data are summarized below.

Hydrologic Data. The hydrologic data for the Chino Basin area includes daily precipitation, daily discharge, daily evaporation, and percolation rates. These data were collected from SBCFCD, USGS, Riverside County Flood Control District (RCFCD), and the County of Los Angeles.

Precipitation Data. Eight rain gauges in the basin, with historical data covering a majority of the simulation period, were selected for the model. The data used in this study were obtained from County of San Bernardino for gages 1026, 1034, 1067, 1192, 2017, 2194, 7619, and the County of Riverside for gages 1021.

Daily Discharge Data. Daily discharge data was obtained from the USGS for San Antonio Creek (11073000 and 11073200) and Cucamonga Creek (11073470).

Evaporation Rates. Evaporative loss from water stored in flood control/recharge basin is based on evaporation data collected at Puddingstone Reservoir located in the City of Pomona. The County of Los Angeles operates and collects data at this station daily.

Percolation Rates. Depth-percolation rate data for the Montclair, Brooks and Turner 1 basins is based on the CBWCD monitoring program. A range of daily percolation rates was developed for other basins based on a combination of previously published values from Table 9 in Recharge in the Upper Santa Ana Valley, Southern California, USGS Open File Report, Moreland, 1972, and personal observation and engineering judgment. Most of the basins studied herein are maintained from a conservation perspective.

Drainage Data. The surface water drainage system delineation was based on topography and the location of flood control structures that exist or will be constructed in the next five years. In general, storm waters flow south towards the Santa Ana River through creeks and flood control channels. The drainage system maps used herein are contained in the Phase 1 Report.

Land Use Data. Existing and future land uses within the watershed are based on available SCAG information for 1993 and the CBWRMS for ultimate conditions. Land uses for the area are based on the Anderson code system which numerically distinguishes various land use types. Land use was used to estimate the amount of pervious and impervious areas within each hydrologic area. Pervious areas consist of agricultural uses, urban landscaping, fields and undeveloped areas which allow some precipitation to infiltrate into the ground. Impervious areas consist of roofs, streets, parking lots and other areas that do not allow percolation of precipitation or runoff. Maps showing the spatial distribution of land uses for 1993, and the ultimate conditions are contained in the Phase 1 Report.

Soils and Hydrologic Soil Type Data. Hydrologic soil type delineation's for the watershed are based on the SCS soil survey for this area are contained in Soil Survey of San Bernardino County, Southwestern Part (SCS, 1977), Soil Survey of Western Riverside County (SCS, 1971) and Soil Survey of the Pasadena Area, California (SCS, 1917), and the San Bernardino County Flood Control Manual. The SCS soil classification system rates soils by runoff potential as an A, B, C or D. The range of soil types is from:

- type "A" soil, low runoff potential and high percolation rates, to
- type "D" soil, high runoff potential and low percolation rates.

The Phase 1 report contains a table and map illustrating the properties and spatial extent of the hydrologic soil types.

Hydrologic soil type and land use are used to develop the curve number (CN). The CN reflects the soils ability to retain rainfall from storm events. CN's are lower for well draining sandy soils and higher for poor draining silty clay soils. The CN was estimated for the pervious part of each land use within each drainage area. A composite CN was calculated for the pervious areas based on the various soil types and land uses and ranged from a low of 39 to a high of 78. The impervious areas were assumed to have a CN of 98. The CN's for each drainage area are listed in the Phase 1 Report.

Operational Characteristics. The operation of the retention and spreading basins is based on storage-area-elevation and outflow curves. Operational data for each basin was taken from existing engineering documents, if available, developed from as-built construction drawings, and communications with SBCFCD and CBWCD staff.

2.5.1.5 Storm Water Recharge Estimates

The daily recharge at each basin was estimated using the daily runoff and routing model. Monthly and annual recharge estimates were developed by aggregating daily recharge values. Other statistics include standard deviation, coefficient of variance, maximum, and minimum, the frequency of recharge occurring in a given month, and the fraction of annual recharge that occurs in a given month. These statistics are not included herein. Recharge estimates for each conservation facility are presented in subsequent chapters of this report. Under ultimate conditions with the recharge improvements described in the OBMP Implementation Plan, the average annual recharge would range from 18,790 to 23,700 acre-ft/yr.

2.5.2 Recycled Water

Table 2-2, developed from information provided in Ref. 2, summarizes the recycled water sources located within the Chino Basin study area. The facilities operated by IEUA represent the best potential source for groundwater recharge and are described in detail below.

Table 2-2
Potential Sources of Recycled Water

Agency	Facility
LA Sanitation District	Pomona Water Reclamation Plant
IEUA	Regional Plant 1
	Regional Plant 2
	Regional Plant 4
	Regional Plant 5
	Carbon Canyon Water Reclamation Plant
City of Upland	Upland Hills Water Reclamation Plant
California Institute for Men at Chino	CIM Water Reclamation Plant
Jurupa Community Services District	Indian Hills Water Reclamation Plant

The combined production of the current wastewater treatment plants is 64,800 acre-feet of water per year. By 2020, the plants are expected to produce 88,700 acre feet of water.

2.5.2.1 Recycled Water Distribution System

IEUA's overall goal is to achieve maximum reuse of all available recycled water. IEUA seeks to construct a Regional Recycled Water Distribution System with four pressure zones, looping the service area, interconnecting all of its water reclamation plants, ensuring direct supply reliability to customers and maximizing the flexibility to recharge all surplus recycled water in flood control groundwater recharge basins. The ultimate development of the Regional Recycled Water

Distribution System will improve operations and reliability, plus provide recycled water throughout the entire service area.

2.5.2.2 Department of Health Services (DHS) Requirements for Groundwater Recharge

For the past several years, DHS has been developing a comprehensive set of regulations governing reclamation criteria for groundwater recharge projects. Currently these proposed regulations have not been adopted, but they do serve as "de facto" criteria when DHS is evaluating each groundwater recharge project on a case-by-case basis. As it stands, DHS does not issue a separate permit, but provides recommendations to the RWQCB when the Regional Board is considering and developing Wastewater Reclamation Requirements.

As stated in the Draft Reclamation Regulations for Groundwater Recharge Reuse Projects, the DHS increased the maximum recycled water contribution (RWC) from 20% of total water recharge to 50% of total water recharge. The groundwater recharge estimates for the basins discussed in this report are based on the prior 20% limit on recycled water. If the new 50% regulation is adopted, the recycled water recharge capacity for each basin could more than double. However, if additional recycled water recharge capacity were desired, additional treatment at one of IEUA's regional plants would be required. This concept will be addressed in IEUAs Recycled Water System Feasibility Study currently under development.

2.5.3 Imported Water

Imported water for artificial recharge is currently available to the region from Metropolitan through IEUA. Metropolitan provides water to southern California from the Colorado River Aqueduct (CRA) and the State Water Project (SWP). SWP water is conveyed into the Chino Basin from the Rialto Pipeline (Foothill Feeder) flowing from east to west across the northern half of the Chino Basin. The location of the Foothill feeder is shown on Figure 2-9.

CRA water comes north in the Upper Feeder from Lake Matthews in Riverside County and enters the Chino Basin in the Jurupa area eventually turns due west and flows west across the middle of the Chino Basin. The Etiwanda Cross Feeder connects the Foothill Feeder to the Upper Feeder in the Etiwanda area. The locations of the Upper Feeder and Etiwanda Cross Feeder are also shown on Figure 2-9. The Upper Feeder west of the Etiwanda Cross Feeder conveys a mix of CRA and SWP water. In the future, other sources of imported water may become available from sources such as groundwater from the Bunker Hill Basin, Santa Ana River water and additional northern California water available through water banking programs.

2.5.3.1 Colorado River Aqueduct (CRA)

CRA Water is essentially no longer used in the Chino Basin due to high concentrations of total dissolved solids (TDS). The high TDS water conveyed through the CRA makes it difficult for wastewater treatment operators to comply with waste discharge requirements in their National Pollutant Discharge Elimination System (NPDES) permits. (The City of Pomona does use a small amount of CRA water blended with other sources.)

2.5.3.2 State Water Project (SWP)

SWP water is used with treatment as municipal supply and without treatment for groundwater replenishment. Several Metropolitan connections on the Foothill Feeder allow SWP water deliveries in the Chino Basin. Table 2-3 lists these connections and provides pertinent information about the connection including location, connection capacity, and connection status. Watermaster use of these connections ranges from a low of about 15 cfs for CB-14T to 75 cfs for CB-59T. Artificial recharge from the designated replenishment connections for the Chino Basin has occurred through the Watermaster since the Basin was adjudicated. Several connections have been severed or dismantled. New connections have been added over time as supply needs to the area have changed. Replenishment deliveries have been reduced in the past few years due to increases in costs of imported water, sale of unproduced groundwater between under-producers and over-producers, and the Watermaster's ability to promote in-lieu surface exchanges for groundwater replenishment. Since 1990, Watermaster replenishment with imported water ranged from no replenishment to a high of about 16,000 acre-ft.

Table 2-3
Metropolitan Connections Within the Chino Basin

Connection Name	Source	Connection Status	Maximum Capacity (cfs)	End User	Use	Location
CB-01	Upper Feeder	Active	50	SCE	Power Generation	Etiwanda Ave. N/O San Bernardino Ave., R.C.
CB-02	Upper Feeder	Active Emergency	20	City of Ontario	Municipal	5th and Berlyn, Ontario
CB-03	Upper Feeder	Severed	N/A			Monte Vista and Margarita, Montclair
CB-04	Upper Feeder	Severed	N/A			5th and Benson, Montclair
CB-05	Upper Feeder	Inactive	20			Archibald and Acacia, R.C.
CB-06	Upper Feeder	Active Emergency	20	FWC	Municipal	Live Oak and San Bernardino, Fontana
CB-07	Upper Feeder	Active	15	CCWD	Municipal	24th St. and Hanley Ave., R.C.
CB-08	Upper Feeder	Dismantled	N/A			Etiwanda and San Sevaine Channel, R.C.
CB-09	Upper Feeder	Severed	N/A			Palo Verde and Ramona, Montclair
CB-10	Upper Feeder	Dismantled	N/A			San Antonio Wash, Upland
CB-11	Upper Feeder	Dismantled	N/A			Archibald and 4th, R.C.
CB-11T	Upper Feeder	Dismantled	N/A			Hermosa and 7th, R.C.
CB-11TB	Foothill Feeder	Dismantled	N/A			Haven Ave. and Banyan, R.C.
CB-12	Foothill Feeder	Active	120	WFA	Municipal	Benson and 18th St., Upland
CB-13T	Foothill Feeder	Active	30	Watermaster	Replenishment	San Sevaine S.G., R.C.
CB-14T	Foothill Feeder	Active	30	Watermaster	Replenishment	Etiwanda S.G., R.C.
CB-15T	Foothill Feeder	Dismantled	N/A			Day Creek S.G., R.C.
CB-16	Foothill Feeder	Active	150	CCWD	Municipal	Etiwanda Ave., and 24th St.
CB-16T	Foothill Feeder	Dismantled	N/A			N/O Summit and W/O Cherry, R.C.
CB-17	Foothill Feeder	Dismantled	N/A			N/O Summit and W/O Cherry, R.C.
OC/CB-59T (2)	Foothill Feeder	Active	75	Watermaster	Replenishment	San Antonio Creek

Notes:
(1) From Reference No. 2
(2) The capacity of this connection is approximately 300 cfs. Average Watermaster use is approximately 75 cfs.

2.5.3.3 Availability of Basis for Imported Water Recharge

Existing Imported Water Recharge Capacity. Artificial recharge of imported water occurs at San Sevaine Nos. 1, 2, and 3; Etiwanda Spreading Grounds; and Montclair Nos. 1, 2, and 3. Recharge is arranged by the Watermaster to satisfy replenishment obligations. Metropolitan typically schedules replenishment deliveries from October through April, and they occur only when SWP water is abundant and available. Metropolitan restricts replenishment deliveries during periods of drought and scheduled outages. Recharge capacities for imported water are dependent on the amount of conservation storage within each basin, percolation rates in each basin, and the ability to introduce imported water into them. The recharge capacity of these basins is about 29,000 acre-ft/yr based on 7 months of recharge and the reported operating characteristics of the basins. Table 2-4 summarizes the size, estimated percolation rate, and source for these basins.

Table 2-4
Spreading Facilities for MWD Replenishment

Spreading Facility	Basin Size (acres)	Percolation Rate(2) (ft/day)	MWD Connection	Limiting Operating Conditions	Max. Daily Recharge Capacity(3) (acre-ft/day)	Max. Annual Recharge Capacity(4) (acre-ft/yr)
Etiwanda Spreading Basins	10	3	CB-14T	Fully open Metropolitan connection delivers up to 15 cfs and fills Basin Nos. 1 and 3 and a portion of Basin No. 4, depending on wash-outs	29.75	4,900
San Sevaine Spreading Basin Nos. 1-3	30	2.5	CB-13T	Fully open Metropolitan connection delivers between 22-25 cfs	43.63	7,000
Montclair Basin Nos. 1-3	22	2.5	CB-59T	SBCFCD allows Basin No. 2 to fill 5 feet below the outlet to Basin No. 3. Under these conditions, CB-59T is opened to nearly full until Basin No. 2 nears the 5-foot mark. Then CB-59T is turned back to approximately 32 cfs for recharge.	63.45	10,400
Total						22,400

Notes:
(1) From Reference No. 2
(2) Reported percolation rates should be field verified.
(3) Calculations based on Watermaster Staff operations during scheduled replenishment period deliveries from Metropolitan.
(4) Calculated annual recharge based on 7 months of recharge during the months of October through April.

Etiwanda Spreading Grounds. Recharge operations at these spreading grounds include the delivery of Metropolitan water into Basin No. 1 from the CB-14T connection. Water deliveries from the connection vary depending on the pressure in the Foothill Feeder, but average about 15 cfs. The resulting recharge rate is about 30 acre-ft/day with a maximum annual capacity of about 4,900 acre-ft/yr. The percolation rate from historical data has been as high as 7 feet per day. The recharge in these basins is limited by the capacity of CB-14T.

San Sevaine Spreading Grounds. Imported water is discharged to Basins No. 1 and No. 2, but can include No. 3 and No. 4 depending on the existing water levels at the start of the spreading period. Spreading operations include water deliveries that can range from 20 to 25 cfs depending on the pressure in the Foothill Feeder at CB-13T. Deliveries from CB-13T are discharged into Basin 1 and spill from one basin to the next. The resulting recharge rate is about 40-acre-ft/day with a maximum annual capacity of about 7,100 acre-ft/yr.

Montclair Basins. Imported water recharge is typically limited to Basins No. 1 and No. 2. Recharge operation includes delivery of imported water from CB-59T via the San Antonio Creek into Basin No. 1. Overflow from Basin No. 1 enters No. 2 through a gated culvert. Historically, Basin No. 2 has been filled up to 5 feet below the outlet to Basin No. 3, but on occasion, Basin No. 3 has been used for recharge. To accomplish this, water deliveries from Metropolitan initially are at 60 to 65 cfs until Basin No. 2 is near the 5-foot mark, then the deliveries are throttled down to 30 cfs. At 30 cfs, the water level remains constant until recharge is terminated. The recharge rate is about 60 acre-ft/day and a maximum annual capacity of 10,400 acre-ft/yr.

Potential Imported Water Recharge Capacity

Capacity to recharge imported water at the existing basins is limited by percolation rates and Metropolitan connection capacities. Imported water recharged in the Montclair Basins is restricted by percolation rates in Basins No. 1 and No. 2. The connection capacity is well above the basins' ability to recharge water shown in Table 2-4. Recharge in the Etiwanda and San Sevaine Spreading areas is limited to the capacity of the connections that serve them water.

There is an inherent conflict in trying to recharge imported water in basins that are used to recharge storm water. Most of the storm water inflow occurs in December through March with recharge occurring in December through April. This is the same period that Metropolitan delivers replenishment water. Therefore, there is some risk that water will be lost if the combination of imported water and storm flows exceed the conservation storage capacity of a basin. Operating rules need to be developed to program the amount of SWP deliveries to all basins that can be used to recharge both imported water and stormflows. The operating rules would define how the basins are to operate on a monthly basis through the year, and how to operate during storm conditions.

INSERT FIGURE 2-1

INSERT FIGURE 2-2

INSERT FIGURE 2-3

INSERT FIGURE 2-4

INSERT FIGURE 2-5

INSERT FIGURE 2-6

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INSERT FIGURE 2-8

INSERT FIGURE 2-9

3.0 EXISTING SYSTEM

3.1 Overview

This chapter presents the results of the field investigation and data review of the existing basins. Improvements to the basins to enhance groundwater recharge are described in Chapter 4.

3.2 Descriptions of Existing Basins

Summaries are provided for the basins listed in Table 3-1. These basins are from Management Zones 1, 2, and 3. Location, ownership, potential recharge sources, and other potential data are presented.

Table 3-1
Existing Sites for Possible Use as Recharge Basins

Basin Name	Page Number
Brooks Street Basin	3-2
Montclair Basins	3-3
Seventh and Eighth Street Basins	3-4
Upland Basin	3-5
Ely Basins	3-6
Etiwanda Spreading Basins	3-7
Hickory Basin	3-8
Lower Day Basin	3-9
San Sevaine Nos. 1-3	3-10
San Sevaine Basins Nos. 4 and 5	3-11
Turner Basin No. 1	3-12
Turner Basin Nos. 2, 3, and 4	3-13
Victoria Basin	3-14
Banana Basin	3-15
Declez Basin	3-16
Etiwanda Conservation Basins	3-17
Jurupa Basin	3-18
Wineville Basin	3-19

4.0 IMPROVEMENTS TO EXISTING SYSTEM

4.1 Overview

This chapter presents preliminary facilities improvements and preliminary cost estimates for rehabilitating existing spreading basins. Improvements at existing basins will improve the ability to recharge storm water, recycled water, and imported water to meet the replenishment obligation in the Chino Basin. Proposed improvements include minor and extensive rehabilitation of existing spreading and flood control basins, new conveyance facilities to convey supplemental water to the spreading grounds, and geotechnical investigations.

4.2 Recharge Capacity and Proposed Recharge Mix at Each Basin

The average annual stormwater recharge is the annual recharge that is expected to occur in a basin over an extended period of time. As discussed in Chapters 1 and 2, the estimates were derived from simulation models developed by the Watermaster and CBWCD [Ref. 1]. The average annual recharge statistic is based on 41 years of daily runoff estimated with the models. The models and data used herein have been completely revised since the Phase 1 Recharge Master Plan was published. Major revisions include incorporation of depth-percolation rate relationships obtained from the CBWCD percolation monitoring program, revised basin geometry and outlet hydraulics, and updates to the input and output features of the Runoff and Router modules. Table 4-1 lists the management zone and storm water and imported water recharge capacity for each basin. The recharge capacities shown in Table 4-1 assume the proposed improvements to the basins have been constructed and the basins are operated to maximize recharge.

Table 4-1
Recharge Capacity and Proposed Recharge Mix at Each Basin

Basin	Mgmt Zone	Range in Storm Water Recharge Capacity (1) (acre-ft/yr)	Range in Imported Water Recharge Capacity (1) (acre-ft/yr)
Brooks Street Basin	1	1,600 to 1,800	2,200 to 3,300
College Heights Basin	1	70 to 100	5,300 to 7,900
Montclair Basin No. 1	1	400 to 400	2,600 to 3,900
Montclair Basin No. 2	1	800 to 800	5,200 to 7,800
Montclair Basin No. 3	1	400 to 400	1,200 to 1,700
Montclair Basin No. 4	1	500 to 500	1,300 to 1,900
Seventh and Eighth Street Basins	1	1,100 to 1,600	1,400 to 2,100
Upland Basin	1	1,000 to 1,000	5,800 to 8,700
Subtotal Management Zone 1		5,870 to 6,600	25,000 to 37,300
Ely Basins	2	2,300 to 2,800	3,400 to 5,100
Etiwanda Spreading Basins (2)	2	1,200 to 1,700	5,800 to 8,600
Hickory Basin	2	600 to 900	3,100 to 4,600
Lower Day Basin	2	400 to 500	2,800 to 4,200
San Sevaine Basin No. 1	2	800 to 900	8,600 to 12,800
San Sevaine Basin No. 2	2	20 to 100	2,900 to 4,400
San Sevaine Basin No. 3	2	600 to 700	3,700 to 5,500
San Sevaine Basin Nos. 4 and 5	2	400 to 500	5,400 to 8,100
Turner Basin No. 1	2	700 to 900	600 to 900
Turner Basin Nos. 2, 3, and 4	2	1,300 to 1,800	2,300 to 3,400
Victoria Basin	2	800 to 1,000	3,400 to 5,100
Subtotal Management Zone 2		9,120 to 11,800	42,000 to 62,700
Banana Basin	3	600 to 800	2,400 to 3,600
Declez Basin	3	200 to 300	1,200 to 1,800
Etiwanda Conservation Ponds	3	800 to 1,100	3,900 to 5,800
IEUA RP-3 Basins	3	1,200 to 1,700	5,800 to 8,600
Jurupa Basin	3	500 to 700	800 to 1,200
Wineville Basin	3	500 to 700	700 to 1,100
Subtotal Management Zone 3		3,800 to 5,300	14,800 to 22,100
Total		18,790 to 23,700	81,800 to 122,100

Notes:
(1) Low estimate assumes recycled water is 20 percent of the total recharge in the basin; high estimate assumes recycled water is 50 percent of the total recharge in the basin.
(2) Joint use of Etiwanda Debris Basin

The daily recharge at each basin was estimated using the daily runoff and routing model. Monthly and annual recharge estimates were developed by aggregating daily recharge values. Other statistics include standard deviation, coefficient of variance, maximum, and minimum, the frequency of recharge occurring in a given month, and the fraction of annual recharge that occurs in a given month. These statistics are not included herein. Imported water recharge is the estimated maximum theoretical annual volume of imported water recharge that can occur for a given monthly operating scheme and utilization, and with the proposed improvements described in this Report. The monthly operating scheme used to develop the anticipated imported water recharge capacity assumed that recharge would occur during the months of October through March and imported water would be in the basins nine out of ten days.

Assuming the proposed improvements identified in this Report are constructed, the average annual recharge capacity for Management Zones 1 through 3 is between 119,380 to 169,500 acre-ft/yr as follows: 18,790 to 23,700 acre-ft/yr storm water; 81,800 to 122,100 acre-ft/yr imported water; and 18,790 to 23,700 acre-ft/yr recycled water. It was assumed that the recycled water recharge capacity would be the same as storm water. As discussed in Chapter 2, DHS criteria for recycled water contribution (RWC) may increase from 20 to 50 percent. If the 50 percent regulation is adopted, the total amount of recycled water recharge capacity could be significantly increased.

4.3 Basis of Design

Preliminary plans and facility improvements were developed for existing spreading basins that can be used to recharge storm water, recycled water, and imported water.

Preliminary operating plans and facilities improvements were developed for the existing spreading basins, using field investigations and drawings of the existing spreading basins from SBCFCD and CBWCD. The facilities were designed in conjunction with feedback from CBWCD, IEUA, and SBCFCD to ensure compatibility with other planned improvements in the Chino Basin. The designs of the basins are at the planning-level and will require significant revision in the final design for construction. The goal of a planning-level design is to determine all major facilities that will need to be constructed, create a general layout of those facilities, and estimate a preliminary cost for the proposed improvements. Improvements to the basins were divided into three different categories: storm water, recycled water, and imported water.

Improvements to increase storm water recharge consist mainly of earthwork to increase percolation and basin storage capacity, new basin inlets, modification of existing inlets to increase conveyance to the basin, and modification of basin outlets to optimize storage and conservation.

The use of imported water for recharge in the spreading basins will require diversions from Metropolitan's Rialto Pipeline and conveyance facilities to each spreading basin. Existing Metropolitan turnouts in the pipeline will be used to divert imported water wherever possible. Expansion of many of these existing turnouts and the construction of several new turnouts will be needed. Once imported water is diverted from the Rialto Pipeline, it will be conveyed to the spreading basins through existing channel systems in the Chino Basin or through proposed pipelines. If an existing channel is used, a diversion structure to divert water from the channel into the basin may be needed.

The use of recycled water in the spreading basins will require the construction of inlet structures, conveyance facilities, and turnouts from the proposed IEUA Regional Recycled Water Distribution System. The IEUA's distribution system will be constructed in phases over the next 10 years, ultimately providing an un-interruptible recycled water source for the majority of the Chino Basin. The proposed improvements to facilitate delivery of recycled water to the spreading basins should be constructed simultaneously with the construction of IEUA's distribution system.

Cost opinions for the proposed improvements were estimated using preliminary cost figures from the CBWCD, cost comparisons from similar projects in California, and material quantity cost estimates. The cost opinions were adjusted to include a contingency factor, an engineering design cost, and an indirect cost.

4.4 Descriptions of Improvements to Existing Basins

The following pages discuss improvements to the basins described in Chapter 3. Potential recharge capacity is defined, and proposed improvements/facilities' costs are presented for storm water, recycled water, and imported water. Preliminary layouts of the proposed facilities are also provided for each basin.

Table 4-2 provides a summary of the proposed basin improvements for storm water and imported water recharge. (Specific facilities associated with recharge of recycled water will be identified as part of IEUA's expanded recycled water program.) Facilities improvements for two new basins, College Heights and RP-3 Recharge Basins, are also shown on Table 4-2 (descriptions of improvements to these new basins are presented in Chapter 5). As shown on the table, the expansion of an existing or construction of a new Metropolitan turnout is a common improvement to many of the recharge basins. Also, modification of existing or construction of new inlet and outlet structures is proposed for all but three of the recharge basins. Optimization of basin geometry (i.e. earthwork, clearing and grubbing, etc.) is proposed for more than half of the recharge basins, while new diversion structures are proposed for approximately one-third of the basins.

Table 4-2
Summary of Proposed Basin Improvements for Storm Water and Imported Water Recharge

Recharge Basin	Proposed Improvement							
	Expand/Construct New Metropolitan Turnout	Construct Pipeline from Turnout to Creek/Channel	Construct Channel Diversion Structure	Construct Pipeline from Diversion Structure to Basin	Modify/Construct Inlet/Outlet Works	Modify/Provide SCADA Monitoring	Optimize Basin Geometry	Construct Facilities for Conveyance Between Two Basins
Brooks Street Basin			☯	☯	☯			
Montclair Basins							☯	
7th & 8th Street Basins	☯(1)	☯			☯	☯	☯	
Upland Basin					☯		☯	☯(7)
Ely Basins	☯	☯			☯	☯		
Etiwanda Spreading Basins	☯(2)							
Hickory Basin	☯(3)	☯	☯		☯		☯	☯(8)
Lower Day Basin	☯(4)	☯			☯			
San Sevaine Basin Nos. 1-3	☯(5)							
San Sevaine Basin Nos. 4 and 5	☯				☯		☯	
Turner Basin No. 1	☯(6)		☯		☯		☯	
Turner Basin Nos. 2, 3, and 4	☯		☯		☯		☯	
Victoria Basin	☯				☯			
Banana Basin	☯	☯	☯		☯		☯	☯
Declez Basin	☯	☯			☯			
Etiwanda Conservation Ponds	☯				☯		☯	
Jurupa Basin	☯	☯			☯			☯(9)
Wineville Basin	☯	☯			☯	☯	☯	
College Heights Basin	☯		☯		☯		☯	☯
RP3 Recharge Basins	☯	☯	☯		☯		☯	☯

Notes:
(1) Shared with Ely Basin.
(2) Shared with Victoria Basin and Etiwanda Conservation Ponds.
(3) Shared with Banana, Declez, Jurupa, and RP-3 Basins.
(4) Shared with Wineville Basin.
(5) Shared with San Sevaine Basin Nos. 4 and 5.
(6) Shared with Turner Basin Nos. 2, 3, and 4.
(7) Facilities provided for conveyance with College Heights Basin.
(8) Facilities provided for conveyance with Banana Basin.
(9) Facilities provided for conveyance with RP-3 Basin.

Figure 4-1 presents the preliminary locations of the proposed expanded/new turnouts. The exact locations will be determined upon close coordination with Metropolitan staff and the SBCFCD.

Table 4-3 provides a summary of the recharge capacity and improvement costs for each basin. The management zone as well as storm water, imported water, and recycled water recharge capacities are summarized for each basin. Also, the estimated capital cost for the proposed improvements is presented. The costs for storm water and imported water recharge facilities are based on the specific facilities identified in Table 4-2. Costs for recycled water facilities will be refined as part of the IEUA program.

Table 4-3
Basin Recharge Capacity and Costs

Recharge Facility	Mgmt. Zone	Potential Recharge Capacity (acre-ft/yr) (1)									Project Capital Cost
		Storm Water			Imported Water			Recycled Water (2)			
Existing Basins											
Brooks Street Basin	1	1,600	to	1,800	2,200	to	3,300	1,600	to	1,800	$1,466,000
Montclair Basin Nos. 1-4	1	2,100	to	2,100	10,300	to	15,300	2,100	to	2,100	$1,858,000
Seventh and Eighth Street Basin	1	1,100	to	1,600	1,400	to	2,100	1,100	to	1,600	$2,048,000
Upland Basin	1	1,000	to	1,000	5,800	to	8,700	1,000	to	1,000	$1,205,000
Ely Basins	2	2,300	to	2,800	3,400	to	5,100	2,300	to	2,800	$2,686,000
Etiwanda Spreading Basins	2	1,200	to	1,700	5,800	to	8,600	1,200	to	1,700	$523,000
Hickory Basin	2	600	to	900	3,100	to	4,600	600	to	900	$2,340,000
Lower Day Creek Basin	2	400	to	500	2,800	to	4,200	400	to	500	$2,540,000
San Sevaine Basin Nos. 1-3	2	1,420	to	1,700	15,200	to	22,700	1,420	to	1,700	$783,000
San Sevaine Basin Nos. 4 and 5	2	400	to	500	5,400	to	8,100	400	to	500	$4,123,000
Turner Basin No. 1	2	700	to	900	600	to	900	700	to	900	$3,995,000
Turner Basin Nos. 2, 3, and 4	2	1,300	to	1,800	2,300	to	3,400	1,300	to	1,800	$3,364,000
Victoria Basin	2	800	to	1,000	3,400	to	5,100	800	to	1,000	$589,000
Banana Basin	3	600	to	800	2,400	to	3,600	600	to	800	$3,134,000
Declez Basin	3	200	to	300	1,200	to	1,800	200	to	300	$2,049,000
Etiwanda Conservation Ponds	3	800	to	1,100	3,900	to	5,800	800	to	1,100	$3,118,000
Jurupa Basin	3	500	to	700	800	to	1,200	500	to	700	$1,700,000
Wineville Basin	3	500	to	700	700	to	1,100	500	to	700	$2,884,000
Total	--	17,520	to	21,900	70,700	to	105,600	17,520	to	21,900	$40,405,000

Notes:
(1) Based on optimum recharge operations. Low estimate assumes a recycled water contribution of 20% and the high estimate assumes a recycled water contribution of 50%
(2) It has been assumed that the average annual recharge of recycled water will be the same as storm water. The recycled water recharge capacity is currently under evaluation by IEUA in it's Recycled Water System Feasibility Study.

4.4.1 Brooks Street Basin

Brooks Street Basin currently receives storm water runoff from local storm drains. Recently, physical modifications to the basin have been constructed by CBWCD to improve percolation rates. Total construction costs for Brooks Street Basin improvements are approximately $1,466,000. Table 4-4 provides a breakdown of the cost for improvements. Figure 4-2 illustrates the proposed facility improvements to Brooks Street Basin.

Owner

CBWCD

Location

Ontario, California

Recharge Area

7.7 acres

Percolation Rate

1.5 ft./day

Potential Recharge Capacity

Storm Water	1,600-1,800 ac-ft/yr
Recycled Water	1,600-1,800 ac-ft/yr
Imported Water	2,200-3,300 ac-ft/yr
Total	5,400-6,900 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Diversion Structure in San Antonio Creek
- 48" RCP Pipeline from Diversion Structure to Basin
- Inlet Structure to Basin
- Outlet Structure to West State Street Storm Channel

Recycled Water

- 900 Ft. Pipeline from the Proposed Non-Regional Montclair 4 Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- None

Table 4-4
Improvement Costs for Brooks Street Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Diversion structure @ San Antonio Creek (1)	1	l.s.	$450,000	$450,000
Pipeline for conveyance to Brooks Basin (2)	1,300	ft	144	187,000
Inlet structure (1)	1	l.s.	50,000	50,000
Outlet to West State St.(1)	1	ea.	150,000	150,000
Subtotal Storm Water Recharge				$837,000
Recycled Water Recharge				
Inlet Structure (2)	1	ea.	$58,000	$58,000
Pipeline (from Montclair 4 Pipeline) (2)	900	ft	96	86,000
Subtotal Recycled Water Recharge				$144,000
Imported Water Recharge				
None				
Total Construction Cost				$981,000
Direct Construction Cost (+ 30% Contingency)	1	l.s.	$1,275,300	$1,275,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	l.s.	191,295	191,000
Total Capital Cost				**$1,466,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values do not include environmental licensing estimate

4.4.2 Montclair Basins

Montclair Basins consist of four existing spreading basins in series – Montclair Basins 1, 2, 3 and 4. These basins receive storm water from the San Antonio Channel and from residential storm drains. If the storage capacity of a basin is exceeded, existing gated or pipe outlets convey water to the subsequent basin downstream and so forth. The second basin contains an emergency spillway that discharges to San Antonio Creek. The fourth and last basin conveys excess water to San Antonio Creek. These basins are currently used: to conserve stormwater, provide minor flood control benefits and for watermaster replenishment. Field observations of the basins revealed that the spreading grounds are in good condition. However, rehabilitating and reshaping the basin floors could increase percolation rates. An existing inlet grate structure at Montclair No. 1 on the San Antonio Channel provides capture of storm water runoff and supplemental imported water for recharge. Total construction costs for the Montclair Basins improvements are approximately $1,858,000. Table 4-5 provides a breakdown of the cost for improvements. Figure 4-3 presents a preliminary layout of the proposed facilities.

Owner

CBWCD

Location

Montclair, California

Recharge Area

28.2 acres

Percolation Rate

1.0 – 2.5 ft./day

Potential Recharge Capacity

Storm Water	2,100 ac-ft/yr
Recycled Water	2,100 ac-ft/yr
Import. Water	10,300-15,300 ac-ft/yr
Total	14,500-19,500 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Optimize Basin for Recharge

Recycled Water

- Pipelines from Montclair 1 Non-Regional Recycled Water Pipeline
- Inlet Structure

Imported Water

- None

Table 4-5
Improvement Costs for Montclair Basins

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Deepen and optimize basin for recharge (1)	160,000	cy	$5	$800,000
Subtotal Storm Water Recharge				$800,000
Recycled Water Recharge				
Pipelines from Montclair Basin Nos. 1-4 (2)	2,200	ft.	$96	$211,000
Inlet structure (2)	4	ls	58,000	232,000
Subtotal Recycled Water Recharge				$443,000
Imported Water Recharge				
None				
Total Construction Costs				$1,243,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$1,615,900	$1,616,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	242,385	242,000
Total Capital Cost				**$1,858,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.3 Seventh and Eighth Street Basins

Total construction costs for the Seventh and Eighth Street Basins improvements are approximately $2,048,000. Table 4-6 provides a breakdown of the cost for improvements. Figure 4-4 presents a preliminary layout of the proposed facilities.

Owner

SBCFCD

Location

Upland, California

Recharge Area

14.5 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	1,100-1,600 ac-ft/yr
Recycled Water	1,100-1,600 ac-ft/yr
Imported Water	1,400-2,100 ac-ft/yr
Total	3,600-5,300 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Optimize Basin Geometry
- Modify Inlet
- Weir with Outlet Gate

Recycled Water

- Pipeline Connecting to Grove Regional Recycled Water Pipeline
- Inlet Structure

Imported Water

- New Turnout Near West Cucamonga Creek (shared with Ely Basins)
- Pipeline from Turnout to West Cucamonga Creek (shared with Ely Basins)

Table 4-6
Improvement Costs for Seventh and Eighth Street Basins

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Deepen and optimize basin geometry for recharge [1]	30,000	cy	$5	$150,000
Inlet modification [1]	1	ea.	100,000	100,000
Weir w/ outlet gate [1]	1	ea.	25,000	25,000
Subtotal Storm Water Recharge				$275,000
Recycled Water Recharge				
Lateral from Grove Regional Pipeline [2]	1,200	ft.	$96	$115,000
Inlet structure [2]	1	ls	58,000	58,000
Subtotal Recycled Water Recharge				$173,000
Imported Water Recharge				
New turnout near West Cucamonga Creek (split w/ Ely) [2]	0.5	ls	$1,000,000	$500,000
Pipeline to West Cucamonga Creek (split w/ Ely)	2,200.0	ft.	192	422,000
Subtotal Imported Water Recharge				$922,000
Total Construction Cost				$1,370,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$1,781,000	$1,781,000
Indirect Cost (15% of Direct Construction Cost) [3] [4]	1	ls	267,150	267,000
Total Capital Cost				**$2,048,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.4 Upland Basin

Previously a quarry site, Upland Basin is located south of the proposed College Heights Basins. Vegetation growth in and along the spreading grounds would require major site clearing and removal of inert fill. Much of the excavation would be necessary to reshape the basin, grading, and internal hydraulics. The existing basin currently collects local storm water runoff for groundwater recharge. An outlet from the proposed College Heights Basin would provide additional storm water and imported water to Upland Basin for recharge. Total construction costs for the Upland Basin improvements are approximately $1,205,000. Table 4-7 provides a breakdown of the cost for improvements. Figure 4-5 presents a preliminary layout of the proposed facilities.

Owner

City of Upland

Location

Upland, California

Recharge Area

10.1 acres

Percolation Rate

3.0 ft./day

Potential Recharge Capacity

Storm Water	1,000 ac-ft/yr
Recycled Water	1,000 ac-ft/yr
Imported Water	5,800-8,700 ac-ft/yr
Total	7,800-10,700 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Inlet Structure
- Deepen and Optimize Basin for Recharge
- Conveyance structure to connect College Heights to Upland
- Spillway Outlet Structure

Recycled Water

- Pipeline from Montclair 1 Pipeline
- Inlet Structure

Imported Water

- None

Table 4-7
Improvement Costs for Upland Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Inlet structure (2)	1	ea.	$50,000	$50,000
Deepen and optimize basin geometry for recharge (2)	82,000	cy.	5	410,000
Conveyance structure to connect College Heights to Upland (2) (bore & jack under road)	200	ft.	500	100,000
Spillway outlet structure (2)	1	ls	150,000	150,000
Subtotal Storm Water Recharge				$710,000
Recycled Water Recharge				
Pipeline (from Montclair 1 Pipeline) (2)	400	ea.	$96	$38,400
Inlet structure (2)	1	ea.	58,000	58,000
Subtotal Recycled Water Recharge				$96,400
Imported Water Recharge				
None				
Total Construction Cost				$806,400
Direct Construction Cost (+ 30% Contingency)	1	ls	$1,048,320	$1,048,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	157,248	157,000
Total Capital Cost				**$1,205,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.5 Ely Basins

Ely Basins consist of three separate basins in series located on the West Cucamonga Channel. Ely Basin No. 1 takes runoff from the West Cucamonga through a channel inlet structure. A low flow outlet and spillway structure at the east end of the basin conveys water into Ely Basin No. 2, and similarly water is distributed to Ely Basin No. 3. Existing pipe outlets and a spillway structure in Ely Basin No. 3 divert excess water back into course on the West Cucamonga Channel. All three basins would require geotechnical investigation to determine if the south embankment is adequate to conserve storm water for prolonged periods of time. Total construction costs for the Ely Basins improvements are approximately $2,686,000. Table 4-8 provides a breakdown of the cost for the improvements. Figure 4-6 presents a preliminary layout of the proposed recharge improvements.

Owner

SBCFCD/CBWCD

Location

Ontario, California

Recharge Area

35.7 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	2,300-2,800 ac-ft/yr
Recycled Water	2,300-2,800 ac-ft/yr
Imported Water	3,400-5,100 ac-ft/yr
Total	8,000-10,700 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Geotechnical Investigation
- Modification to Outlet Works
- Low Level Control Berms
- Monitoring Wells

Recycled Water

- Inlet Structure
- Lateral from Proposed Regional Pipeline
- SCADA (with Telemetry)

Imported Water

- New Turnout Near West Cucamonga Creek (shared with Seventh and Eighth Street Basins)
- Pipeline from Turnout to West Cucamonga Creek (shared with Seventh and Eighth Street Basins)

Table 4-8
Improvement Costs for Ely Basins

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Geotechnical investigation [(2)]	1	ls	$150,000	$150,000
Modify outlet works for conservation storage [(2)]	1	ea.	150,000	150,000
Low level control berms to control nuisance flows [(2)]	1	ls	10,000	10,000
Monitoring Wells	1	ea.	300,000	300,000
Subtotal Storm Water Recharge				$610,000
Recycled Water Recharge				
Inlet structure [(2)]	1	ls	$58,000	$58,000
Lateral from proposed regional pipeline [(2)]	2,000	ft.	96	192,000
SCADA (w/ telemetry) [(2)]	1	ea.	15,000	15,000
Subtotal Recycled Water Recharge				$265,000
Imported Water Recharge				
New turnout near West Cucamonga Creek (split w/ 7th & 8th Street Basins) [(2)]	0.5	ls	$1,000,000	$500,000
Pipeline to West Cucamonga Creek (split w/ 7th & 8th Street Basins)	2,200	ft.	192	422,000
Subtotal Imported Water Recharge				$922,000
Total Construction Cost				$1,797,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,336,100	$2,336,000
Indirect Cost (15% of Direct Construction Cost) [(3) (4)]	1	ls	350,415	350,000
Total Capital Cost				**$2,686,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.6 Etiwanda Spreading Basins

The SBCFCD are currently planning improvements for the Etiwanda Spreading Basins. These improvements include restoring the northern section of the basins above 24th Street to its natural environment, and creating a basin south of 24th Street. Total construction costs for the Etiwanda Spreading Basins improvements are approximately $523,000. Table 4-9 provides a breakdown of the cost for improvements. It should be noted that depending on the final improvements made to the basin by SBCFCD, the costs presented here could change significantly. Specifically, if excavation of the basin for conservation storage becomes necessary. Figure 4-7 illustrates displays the proposed facility improvements to Etiwanda Spreading Basins.

Owner

SBCFCD

Location

Rancho Cucamonga, California

Recharge Area

20.0 acres

Percolation Rate

3.0 ft./day

Potential Recharge Capacity

Storm Water	1,200-1,700 ac-ft/yr
Recycled Water	1,200-1,700 ac-ft/yr
Imported Water	5,800-8,600 ac-ft/yr
Total	8,200-12,000 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- None

Recycled Water

- 1,300-ft. pipeline connecting with Wilson Recycled Reservoir
- Inlet Structure to Basin

Imported Water

- Expand CB-14T turnout on the Rialto Pipeline (Share Costs with Etiwanda Conservation Basins and Victoria Basin)

Table 4-9
Improvement Costs for Etiwanda Spreading Basins

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
None				
Recycled Water Recharge				
Inlet structure (2)	1	ea.	58,000	58,000
Pipeline from Wilson Recycled Water Reservoir (2)	1,300	lf	96	125,000
Subtotal Recycled Water Recharge				183,000
Imported Water Recharge				
Expand CB-14T (split w/ Etiwanda Conserv. & Victoria) (2)	0.33	ls	500,000	167,000
Subtotal Imported Water Recharge				167,000
Total Construction Cost				350,000
Direct Construction Cost (+ 30% Contingency)	1	ls	455,000	455,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	68,250	68,000
Total Capital Cost				**523,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.7 Hickory Basin

Hickory Basin is located east of the San Sevaine Channel and along the Santa Fe Railroad tracks.

Hickory Basin would not only operate as a spreading basin for groundwater recharge, but also as a supply reservoir for Banana Basin. Banana Basin is located in a remote location approximately 500 feet to the east of Hickory Basin. Only local storm water currently flows to Banana Basin. In order to increase the recharge capacity of Banana Basin, a pump station is planned at Hickory Basin to pump water east through a conveyance pipeline to Banana Basin. Total construction costs for Hickory Basin improvements are approximately $2,340,000. Table 4-10 provides a breakdown of the costs for improvements. Figure 4-8 displays the proposed facility improvements to Hickory Basin.

Owner

SBCFCD

Location

Fontana, California

Recharge Area

8.0 acres

Percolation Rate

2.0 ft./day

Potential Recharge Capacity

Storm Water	600-900 ac-ft/yr
Recycled Water	600-900 ac-ft/yr
Imported Water	3,100-4,600 ac-ft/yr
Total	4,300-6,400 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Drop Inlet Structure in San Sevaine Channel (Share Costs with Banana Basin)
- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge
- Monitoring Wells

Recycled Water

- 700-ft. pipeline connecting the Whittram Ave. Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout at Etiwanda Forebay (Share Costs with Banana, Declez, Jurupa, and RP-3 Basins)
- 5,000-ft. pipeline to connect new turnout with Hickory Basin (Share Costs with Banana, Declez, Jurupa, and RP-3 Basins)

Table 4-10
Improvement Costs for Hickory Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Modify outlet works for conservation storage (2)	1	ls	$150,000	$150,000
Deepen and optimize basin for recharge (2)	65,000	cy	5	325,000
Monitoring Wells	1	ea.	300,000	300,000
Drop inlet structure @ San Sevaine Creek (2) (split w/ Banana)	0.5	ea.	450,000	225,000
Subtotal Storm Water Recharge				$1,000,000
Recycled Water Recharge				
Inlet structure (2)	1.000	ea.	$58,000	$58,000
Pipeline from proposed Whittram Ave. Regional Pipeline (2)	700	ft.	96	67,000
Subtotal Recycled Water Recharge				$125,000
Imported Water Recharge				
New Turnout (split cost) (2)	0.20	ls	$1,000,000	$200,000
Pipeline from New Turnout (split cost) (2)	1000	ls	240	240,000
Subtotal Imported Water Recharge				$440,000
Total Construction Cost				$1,565,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,034,500	$2,035,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	305,175	305,000
Total Capital Cost				**$2,340,000**

Notes:

(1) CBWCD

(2) B&V

(3) Includes administration, design, and construction management

(4) Values does not include environmental licensing estimate

4.4.8 Lower Day Creek Basin

The Lower Day Creek Basin is comprised of an upper basin and a lower basin. The Lower Day Creek Basin receives runoff primarily from a housing development to the northeast; however, during major flood events (100 years or greater), storm runoff from the adjacent Day Creek is diverted directly into the lower spreading basin for retention. A pipeline connects the upper basin to the lower basin. Improvements to Lower Day Creek Basin include a new turnout and a new conveyance pipeline from the Metropolitan turnout at Rialto Pipeline to Lower Day Creek Basin. Due to the severity of slope in the Day Creek Channel, a conveyance pipeline is required to import water into Lower Day. Total construction costs for Lower Day Basin improvements are approximately $2,540,000. Table 4-11 provides a breakdown of the costs for improvements. Figure 4-9 displays the proposed facility improvements to Lower Day Basin.

Owner

SBCFCD

Location

Rancho Cucamonga, California

Recharge Area

14.4 acres

Percolation Rate

1.0 ft./day

Potential Recharge Capacity

Storm Water	400-500 ac-ft/yr
Recycled Water	400-500 ac-ft/yr
Imported Water	2,800-4,200 ac-ft/yr
Total	3,600-5,200 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Modify Outlet Works for Conservation Storage

Recycled Water

- 200-ft. pipeline connecting to Wineville Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout on Rialto Pipeline (Share Costs with Wineville Basin)
- 4,000-ft. pipeline connecting turnout with Lower Day Basin (Share Costs with Wineville Basin)
- Inlet Structure
- Bore & Jack at intersection of Highland Avenue and Day Creek Channel

Table 4-11
Improvement Costs for Lower Day Creek Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Modify outlet works for conservation storage (2)	1	ls	$150,000	$150,000
Subtotal Storm Water Recharge				$150,000
Recycled Water Recharge				
Lateral from proposed nonregional pipeline (2)	4,300	ft.	$144	$619,000
Inlet structure (2)	1	ls	58,000	58,000
Subtotal Recycled Water Recharge				$677,000
Imported Water Recharge				
Inlet structure (2)	1	ea.	$30,000	$30,000
New Turnout (split w/ Wineville Basin) (2)	0.5	ea.	1,000,000	500,000
Pipeline from Metropoltian turnout to basin inlet (split w/ Wineville Basin) (2)	2,000.0	ft.	96	192,000
Bore & Jack @ Highland Ave. & Day Creek Channel (3)	300	ft.	500	150,000
Subtotal Imported Water Recharge				$872,000
Total Construction Cost				$1,699,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,208,700	$2,209,000
Indirect Cost (15% of Direct Construction Cost) (4) (5)	1	ls	331,305	331,000
Total Capital Cost				**$2,540,000**

Notes:
(1) CBWCD
(2) B&V
(3) Unit cost based on "Facility Planning Study Chino Basin Conjunctive-Use Demonstration Project" by CH2M Hill, 1995
(4) Includes administration, design, and construction management
(5) Values does not include environmental licensing estimate

4.4.9 San Sevaine Basin Nos. 1, 2, and 3

San Sevaine Basin Nos. 1, 2, and 3 are located along the north side Interstate 15, and are part of the San Sevaine Channel System. The SBCFCD San Sevaine Creek Water Project proposes to operate these basins as debris basins under this project. The county's proposal includes improvements to the inlet and outlet works and revegetation of the area. Total construction costs for San Sevaine Basin Nos. 1, 2, and 3 improvements are approximately $783,000. Table 4-12 provides a breakdown of the costs for improvements. Figure 4-10 displays the proposed facility improvements to San Sevaine Basin Nos. 1, 2, and 3.

Owner

SBCFCD

Location

Rancho Cucamonga, California

Recharge Area

33.6 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	1,420-1,700 ac-ft/yr
Recycled Water	1,420-1,700 ac-ft/yr
Import. Water	15,200-22,900 ac-ft/yr
Total	18,040-26,300 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- None

Recycled Water

- 1,500-ft. pipeline connecting the North Etiwanda Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- Expand Metropolitan on Rialto Pipeline (Share Costs with San Sevaine 4 and 5)

Table 4-12
Improvement Costs for San Sevaine Basin Nos. 1, 2, and 3

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
None				
Recycled Water Recharge				
Inlet Structure [(2)]	1	ls	$58,000	$58,000
Lateral from proposed North Etiwanda Regional Pipeline [(2)]	1,500	ft.	144	216,000
Subtotal Recycled Water Recharge				$274,000
Imported Water Recharge				
Expand Metropolitan Turnout (Split with SS 4,5) [(2)]	0.5	ls	$500,000	$250,000
Subtotal Imported Water Recharge				$250,000
Total Construction Cost				$524,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$681,200	$681,000
Indirect Cost (15% of Direct Construction Cost) [(3) (4)]	1	ls	102,180	102,000
Total Capital Cost				**$783,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.10 San Sevaine Basin Nos. 4 and 5

San Sevaine Basin Nos. 4 and 5 are located along the north side Interstate 15, and are part of the San Sevaine Channel System. The SBCFCD San Sevaine Creek Water Project proposes to operate these basins as flood control and debris basins under this project. The county's proposal includes improvements to the inlet and outlet works and revegetation of the area. Total construction costs for San Sevaine Basins 4 and 5 improvements are approximately $4,123,000. Table 4-13 provides a breakdown of the cost for improvements. Figure 4-11 illustrates the proposed facility improvements to San Sevaine Basin Nos. 4 and 5.

Owner

SCBCFCD

Location

Rancho Cucamonga, California

Recharge Area

56.5 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	400-500 ac-ft/yr
Recycled Water	400-500 ac-ft/yr
Imported Water	5,400-8,100 ac-ft/yr
Total	6,200-9,100 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge

Recycled Water

- 400-ft. pipeline connecting the North Etiwanda Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- Expand Metropolitan on Rialto Pipeline (Share Costs with San Sevaine 1, 2, and 3)

Table 4-13
Improvement Costs for San Sevaine Basin Nos. 4 and 5

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Deepen and optimize basin for recharge [(1)]	450,000	cy	$5	$2,250,000
Modify outlet works for conservation storage [(2)]	1	ls	150,000	150,000
Subtotal Storm Water Recharge				$2,400,000
Recycled Water Recharge				
Inlet Structure [(2)]	1	ls	$58,000	$58,000
Lateral from proposed North Etiwanda Regional Pipeline [(2)]	400	ft.	124	50,000
Subtotal Recycled Water Recharge				$108,000
Imported Water Recharge				
Expand Metropolitan Turnout (split with San Sevaine Basins Nos. 1-3) [(2)]	0.5	ls	$500,000	$250,000
Subtotal Imported Water Recharge				250,000
Total Construction Cost				$2,758,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$3,585,400	$3,585,000
Indirect Cost (15% of Direct Construction Cost) [(3)] [(4)]	1	ls	537,810	538,000
Total Capital Cost				**$4,123,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.11 Turner Basin No. 1

The Turner Basins are located at the confluence between Cucamonga Creek Channel and Deer Creek Channel. Turner Basin No. 1 diverts water from the Cucamonga Creek Channel, routes the water through the basin for groundwater recharge, and delivers any overflow water back into the Cucamonga Creek Channel. Total construction costs for Turner Basin No. 1 improvements are approximately $3,995,000. Table 4-14 provides a breakdown of the costs for improvements. Figure 4-12 displays the proposed facility improvements to Turner Basin No. 1.

Owner

SBCFCD

Location

Ontario, California

Recharge Area

6.2 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	700-900 ac-ft/yr
Recycled Water	700-900 ac-ft/yr
Imported Water	600-900 ac-ft/yr
Total	2,000-2,700 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Drop Inlet Structure at Deer Creek Channel (share with Turner Basin Nos. 2, 3, and 4)
- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge
- Low Level Control Berm for Nuisance Flows
- Monitoring Wells

Recycled Water

- 300-ft. pipeline connecting the 4th Street Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout on Rialto Pipeline near Deer Creek (shared with Turner Basin Nos. 2, 3, and 4)

Table 4-14
Improvement Costs for Turner Basin No. 1

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Modify outlet works for conservation storage	1	ls	$100,000	$100,000
Drop inlet structure at Deer Creek (split with Turner Basin Nos. 2, 3, and 4)	1	ea.	450,000	225,000
Deepen & optimize basin geometry for recharge (2)	200,000	cy	5	1,000,000
Monitoring Wells	1	ea.	300,000	300,000
Low level control berms to control nuisance flows (2)	1	ls	10,000	10,000
Subtotal Storm Water Recharge				$1,635,000
Recycled Water Recharge				
Inlet structure (2)	1	ea.	$58,000	$58,000
Lateral from proposed 4th. St. Regional Pipeline (2)	300	ft.	96	29,000
Subtotal Recycled Water Recharge				$87,000
Imported Water Recharge				
New turnout @ Rialto Pipeline near Deer Creek (2)	0.5	ls	$1,000,000	$500,000
New inlet Structure	1	ls	450,000	450,000
Subtotal Imported Water Recharge				$950,000
Total Construction Cost				$2,672,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$3,473,600	$3,474,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	521,040	521,000
TOTAL CAPITAL COST				**$3,995,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.12 Turner Basin Nos. 2, 3, and 4

The Turner Basin Nos. 2, 3, and 4 are located at the confluence between Cucamonga Creek Channel and Deer Creek Channel. Presently the diversion pipe from Deer Creek Channel is blocked by sediment. Through excavation of the basin, Turner Basin Nos. 2, 3, and 4 will again divert water from the Deer Creek Channel, route the water through the basins for groundwater recharge, and deliver any overflow water back into the Deer Creek Channel. Total construction costs for Turner Basin Nos. 2, 3, and 4 improvements are approximately $3,364,000. Table 4-15 provides a breakdown of the costs for improvements. Figure 4-13 displays the proposed facility improvements to Turner Basin Nos. 2, 3, and 4.

Owner

SBCFCD

Location

Ontario, California

Recharge Area

23.3 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	1,300-1,800 ac-ft/yr
Recycled Water	1,300-1,800 ac-ft/yr
Imported Water	2,300-3,400 ac-ft/yr
Total	4,900-7,000 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Drop Inlet Structure at Deer Creek Channel (share with Turner Basin No. 1)
- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge
- Low Level Control Berm for Nuisance Flow
- Monitoring Wells

Recycled Water

- 800-ft. pipeline connecting the 4th Street Regional Recycled Water Pipeline
- Inlet Structure to Basin
- Bore and Jack Pipeline under Deer Creek Channel

Imported Water

- New turnout on Rialto Pipeline near Deer Creek (shared with Turner Basin No. 1)

Table 4-15
Improvement Costs for Turner Basin Nos. 2, 3, and 4

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Drop inlet structure @ Deer Creek (2)	1	ea.	$450,000	$225,000
Low level control berms for nuisance flows (2)	1	ea.	10,000	10,000
Monitoring Wells	1	ea.	300,000	300,000
Modify outlet works for conservation storage (2)	1	ls.	100,000	100,000
Deepen basin to create conservation pool	188,000	cy	5	940,000
Subtotal Storm Water Recharge				$1,575,000
Recycled Water Recharge				
Inlet Structure (2)	1	ls	$58,000	$58,000
Lateral from proposed 4th St. Regional Pipeline (2)	700	ft.	96	67,000
Bore & Jack @ Deer Creek (3)	100	ft.	500	50,000
Subtotal Recycled Water Recharge				$175,000
Imported Water Recharge				
New turnout @ Rialto Pipeline near Deer Creek (2)	0.5	ea.	$1,000,000	$500,000
Subtotal Imported Water Recharge				$500,000
Total Construction Cost				$2,250,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,925,000	$2,925,000
Indirect Cost (15% of Direct Construction Cost) (4) (5)	1	ls	438,750	439,000
Total Capital Cost				**$3,364,000**

Notes:
(1) CBWCD
(2) B&V
(3) Unit cost based on "Facility Planning Study Chino Basin Conjunctive-Use Demonstration Project" by CH2M Hill, 1995
(4) Includes administration, design, and construction management
(5) Values does not include environmental licensing estimate

4.4.13 Victoria Basin

Victoria Basin is located north of Interstate 15 on the western side of the Etiwanda Channel. Victoria Basin currently only receives runoff from nearby developments. The Victoria Basin has been included as part of the proposed SBCFCD San Sevaine Creek Water Project, and would be operated as a flood flow retention basin under this project. SBCFCD has plans to construct an inlet structure from Etiwanda Channel to divert additional storm water flow and imported water. Total construction costs for Victoria Basin improvements are approximately $589,000. Table 4-16 provides a breakdown of the costs for improvements. Figure 4-14 displays the proposed facility improvements to Victoria Basin.

Owner

SBCFCD

Location

Rancho Cucamonga, California

Recharge Area

11.8 acres

Percolation Rate

1.5 ft./day

Potential Recharge Capacity

Storm Water	800-1,000 ac-ft/yr
Recycled Water	800-1,000 ac-ft/yr
Imported Water	3,400-5,100 ac-ft/yr
Total	5,000-7,100 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Modify Outlet Works for Conservation Storage

Recycled Water

- 200-ft. pipeline connecting the proposed North Etiwanda Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- Expand CB-14T turnout on the Rialto Pipeline (Share Costs with Etiwanda Spreading Basins and Etiwanda Conservation Basin)

Table 4-16
Improvement Costs for Victoria Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Modify outlet works for conservation (2)	1	ls	$150,000	$150,000
Subtotal Storm Water Recharge				$150,000
Recycled Water Recharge				
Inlet Structure (2)	1	ea.	$58,000	$58,000
Lateral from proposed North Etiwanda Regional Line (2)	200	ft	96	19,000
Subtotal Recycled Water Recharge				$77,000
Imported Water Recharge				
Expand CB-14T (split w/ Etiwanda Spreading Basins & Conservation Ponds) (2)	0.33	ls	$500,000	$167,000
Subtotal Imported Water Recharge				$167,000
Total Construction Cost				$394,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$512,200	$512,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	76,830	77,000
Total Capital Cost				**$589,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.14 Banana Basin

Banana Basin is a small basin on a natural drainage channel that collects residential storm water. The basin is located east of Hickory Basin along the Santa Fe Railroad and is currently not supplied by any major storm water channels. In order to increase the recharge capacity of Banana Basin, stored water in Hickory Basin will be pumped east through a conveyance pipeline to Banana Basin. This will require design and construction of a new pump station at Hickory Basin and a pipeline to Banana Basin. Total construction cost for Banana Basin improvements is approximately $3,134,000. Table 4-17 provides a breakdown of the costs for improvements. Figure 4-15 displays the proposed facility improvements to Banana Basin.

Owner

SBCFCD

Location

Fontana, California

Recharge Area

6.2 acres

Percolation Rate

2.0 ft./day

Potential Recharge Capacity

Storm Water	600-800 ac-ft/yr
Recycled Water	600-800 ac-ft/yr
Imported Water	2,400-3,600 ac-ft/yr
Total	3,600-5,200 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Drop Inlet Structure in San Sevaine Channel (Share Costs with Hickory Basin)
- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge
- Hickory Basin Pump Station
- Pipeline from Hickory Basin to Banana Basin
- Monitoring Wells

Recycled Water

- 100-ft. pipeline connecting the Whittram Avenue Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout at Etiwanda Forebay (Share Costs with Hickory, Declez, Jurupa, and RP-3 Basins)
- 5,000-ft. pipeline to connect new turnout with Hickory Basin (Share Costs with Hickory, Declez, Jurupa, and RP-3 Basins)

Table 4-17
Improvement Costs for Banana Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Drop inlet structure (split w/ Hickory) (2)	0.5	ea.	$450,000	$225,000
Outlet works modification for conservation storage (2)	1	ls	150,000	150,000
Deepen and optimize basin geometry for recharge (2)	50,000	cy	5	250,000
Monitoring Wells	1	ea.	300,000	300,000
Hickory Pump Station (2)	1	ls	231,000	231,000
Pipeline from Hickory to Banana Basin (2)	4,500	ft.	96	432,000
Subtotal Storm Water Recharge				$1,588,000
Recycled Water Recharge				
Inlet Structure (2)	1	ea.	$58,000	$58,000
Pipeline from proposed Whittram Ave. Regional Pipeline (2)	100	ft.	96	10,000
Subtotal Recycled Water Recharge				$68,000
Imported Water Recharge				
New Turnout (split cost) (2)	0.20	ls	$1,000,000	$200,000
Pipeline from New Turnout(split cost) (2)	1,000	ls	240	240,000
Subtotal Imported Water Recharge				$440,000
Total Construction Cost				$2,096,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,724,800	$2,725,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	408,720	409,000
Total Capital Cost				**$3,134,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.15 Declez Basin

Declez Basin is a flow-through basin on the Declez Conveyance Channel located southeast of the intersection between Mulberry and Philadelphia Street. The only way to deliver imported water to the Basin is via the proposed RP-3 Basin upstream. Because of this reliance on the RP-3 Basin for imported water, some of the improvements proposed for RP-3 are shared with the Declez Basin. Total construction costs for Declez Basin improvements are approximately $2,049,000. Table 4-18 provides a breakdown of the costs for improvements. Figure 4-16 displays the proposed facility improvements to Declez Basin.

Owner

SBCFCD

Location

Jurupa, California

Recharge Area

6.0 acres

Percolation Rate

1.0 ft./day

Potential Recharge Capacity

Storm Water	200-300 ac-ft/yr
Recycled Water	200-300 ac-ft/yr
Imported Water	1,200-1,800 ac-ft/yr
Total	1,600-2,400 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Internal Check Dams
- Outlet Structures for Check Dams

Recycled Water

- 1,800 ft. pipeline connecting proposed Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout at Etiwanda Forebay (share costs with Hickory, Banana, Jurupa, and RP-3 Basins)
- 5,000-ft. pipeline to connect new turnout with Hickory Basin (Share costs with Hickory, Banana, Jurupa, and RP-3 Basins)
- Jurupa Pump Station (share costs with RP-3 Basin)
- Pipeline from Jurupa Basin to RP-3 Basin (share costs with RP-3 Basin)

Table 4-18
Improvement Costs for Declez Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Internal check dam (2)	3	ea.	$5,000	$15,000
Outlet structure for check dam (2)	3	ea.	30,000	90,000
Subtotal Storm Water Recharge				$105,000
Recycled Water Recharge				
Inlet structure (2)	1	ea.	$58,000	$58,000
Pipeline from proposed regional pipeline (2)	1800	ft	96	173,000
Subtotal Recycled Water Recharge				$231,000
Imported Water Recharge				
New Turnout (split cost) (2)	0.20	ls	$1,000,000	$200,000
Pipeline from New Turnout (split cost) (2)	1000	ls	240	240,000
Pipeline from Jurupa Basin to RP-3 (2) (split w/ RP-3)	5,000	ft.	96	480,000
Jurupa pump station (2) (split w/ RP-3)	1	ls	230,000	115,000
Subtotal Imported Water Recharge				$1,035,000
Total Construction Cost				$1,371,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$1,782,300	$1,782,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	267,345	267,000
Total Capital Cost				**$2,049,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.16 Etiwanda Conservation Ponds

A series of ten percolation ponds exist along Etiwanda Avenue between San Bernardino Road and the I-10 Freeway. The Etiwanda Conservation Ponds were designed to divert a portion of the flow out of Etiwanda Creek and route these flows through the series of basins. Presently, the facility is not working properly and the majority if not all of the potential recharge is being lost downstream. A development has been proposed west of Etiwanda Avenue that will convert these basins to flow-through facilities. As a flow-through facility all of the flow in Etiwanda Creek will be routed through the Basins. However, recent reports are the proposed development has been abandoned. Total construction costs for the Etiwanda Conservation Ponds improvements are approximately $3,118,000. Table 4-19 provides a breakdown of the costs for improvements. Figure 4-17 displays the proposed facility improvements to Etiwanda Conservation Ponds.

Owner

SBCFCD

Location

Fontana, California

Recharge Area

20.0 acres

Percolation Rate

1.0 ft./day

Potential Recharge Capacity

Storm Water	800-1,100 ac-ft/yr
Recycled Water	800-1,100 ac-ft/yr
Imported Water	3,900-5,800 ac-ft/yr
Total	5,500-8,000 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Interim Storm Drains to handle increased flows as a flow-through facility
- Abandoning the existing culvert on 4th and Etiwanda Ave.
- Deepen and Optimize Basin for Recharge
- Improve Basin Outlets and Overflow Spillways
- Modify Existing System Outlet Structure
- Monitoring Wells

Recycled Water

- 50-ft. pipeline connecting with proposed 4th Street Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- Expand CB-14T turnout on the Rialto Pipeline (share costs with Etiwanda Spreading Basins and Victoria Basin)

Table 4-19
Improvement Costs for Etiwanda Conservation Ponds

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Interim quad 48-inch storm drain (2)	100	ft.	$400	$40,000
Abandon existing culvert on 4th & Etiwanda Ave. (2)	1	ls	20,000	20,000
Deepen and optimize basins for recharge (2)	161,000	ls	5	805,000
Interm double 54-inch storm drain (2)	100	ft.	450	45,000
Overflow Spillways (2)	9	ea.	15,000	135,000
Monitoring Wells	1	ea.	300,000	300,000
Improve basin outlets (2)	9	ea.	40,000	360,000
Extend and modify existing outlet structure (2)	1	ls	150,000	150,000
Subtotal Storm Water Recharge				$1,855,000
Recycled Water Recharge				
Inlet structure (2)	1	ls	$58,000	$58,000
Lateral from proposed 4th St. regional pipeline (2)	50	ft.	96	5,000
Subtotal Recycled Water Recharge				$63,000
Imported Water Recharge				
Expand CB-14T (split w/ Victoria & Etiwanda Spreading Basins) (2)	0.33	ls	$500,000	$167,000
Subtotal Imported Water Recharge				$167,000
Total Construction Cost				$2,085,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,710,500	$2,711,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	406,575	407,000
Total Capital Cost				**$3,118,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.17 Jurupa Basin

Jurupa Basin is located on about 60 acres east of the existing unlined channel at Jurupa Avenue. This basin is designed as a bypass basin to receive peak flows from San Sevaine Conveyance Channel. SBCFCD currently plans to construct an inlet that would divert storm, imported and recycled water into Jurupa Basin for conservation. Water stored in Jurupa Basin could be pumped to the proposed RP-3 spreading basin site. Total construction costs for Jurupa Basin improvements is approximately $1,700,000. Table 4-20 provides a breakdown of the costs for improvements. Figure 4-18 displays the proposed facility improvements to Jurupa Basin.

Owner

SBCFCD

Location

Jurupa, California

Recharge Area

39.0 acres

Percolation Rate

0.1 ft./day

Potential Recharge Capacity

Storm Water	500-700 ac-ft/yr
Recycled Water	500-700 ac-ft/yr
Imported Water	800-1,200 ac-ft/yr
Total	1,800-2,600 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Modify Outlet Works for Conservation Storage
- Provide Internal Levee
- Monitoring Wells

Recycled Water

- 200-ft. pipeline connecting with the Regional Jurupa Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout at Etiwanda Forebay (Share Costs with Hickory, Banana, Declez, and RP-3 Basins)
- 5,000-ft. pipeline to connect new turnout with Hickory Basin (Share Costs with Hickory, Banana, Declez, and RP-3 Basins)

Table 4-20
Improvements Costs for Jurupa Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Provide internal levee or dam (2)	1	ls	$170,000	$170,000
Monitoring Wells	1	ea.	300,000	300,000
Modify outlet works for conservation storage (2)	1	ea.	150,000	150,000
Subtotal Storm Water Recharge				$620,000
Recycled Water Recharge				
Inlet structure (2)	1	ls	$58,000	$58,000
Lateral from proposed regional pipeline (2)	200	ft.	96	19,000
Subtotal Recycled Water Recharge				$77,000
Imported Water Recharge				
New Turnout (split cost) (2)	0.20	ls	$1,000,000	$200,000
Pipeline from New Turnout (split cost) (2)	1,000	ls	240	240,000
Subtotal Imported Water Recharge				$440,000
Total Construction Cost				$1,137,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$1,478,100	$1,478,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	221,715	222,000
Total Capital Cost				**$1,700,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

4.4.18 Wineville Basin

The Wineville Basin receives water from Day Creek and the Etiwanda Channel. At the northeast corner, flows from Day Creek enter the basin through a concrete ramp inlet. Flows from Etiwanda Channel enter the basin through a concrete ramp inlet on the east side of the basin. There are two outlets to the basin, and both deliver water to the Lower Day Creek Channel. Total construction costs for the Wineville Basin improvements are approximately $2,884,000. Table 4-21 provides a breakdown of the costs for improvements. Figure 4-19 illustrates the proposed facility improvements to Wineville Basin.

Owner

SBCFCD

Location

Ontario, California

Recharge Area

36.0 acres

Percolation Rate

0.5 ft./day

Potential Recharge Capacity

Storm Water	500-700 ac-ft/yr
Recycled Water	500-700 ac-ft/yr
Imported Water	700-1,100 ac-ft/yr
Total	1,700-2,500 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Geotechnical investigation of basin sides to determine stability
- Modify Outlet Works for Conservation Storage
- Deepen and Optimize Basin for Recharge
- Monitoring Wells

Recycled Water

- 200-ft. pipeline connecting to Wineville Regional Recycled Water Pipeline
- Inlet Structure to Basin

Imported Water

- New turnout on Rialto Pipeline (Share Costs with Lower Day Basin)
- 4,000-ft. pipeline connecting to turnout to Lower Day Basin (Share Costs with Lower Day Basin)

Table 4-21
Improvement Costs for Wineville Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Geotechnical investigation (2)	1	ls	$150,000	$150,000
Modify outlet works for conservation storage (2)	1	ea.	150,000	150,000
Monitoring Wells	1	ea.	300,000	300,000
Deepen and Optimize Basin for Recharge (2)	112,000	cy	5	560,000
Subtotal Storm Water Recharge				$1,160,000
Recycled Water Recharge				
Inlet structure (2)	1	ea.	$58,000	$58,000
Lateral from Wineville Regional Pipeline (2)	200	ft.	96	19,000
Subtotal Recycled Water Recharge				$77,000
Imported Water Recharge				
New Turnout (split w/ Lower Day) (2)	0.5	ea.	$1,000,000	$500,000
Pipeline from Metropoltian turnout to basin inlet (split w/ Lower Day Basin) (2)	2,000	ft.	96	192,000
Subtotal Imported Water Recharge				$692,000
Total Construction Cost				$1,929,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$2,507,700	$2,508,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	376,155	376,000
Total Capital Cost				**$2,884,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

INSERT FIGURES 4-1 THROUGH 4-19

5.0 DEVELOPMENT OF NEW RECHARGE AREAS

5.1 Overview

In addition to the existing basins, this study considered development of new basins, development of on-site recharge, and groundwater injection wells.

5.2 Development of New Basins

This subsection reviews development of the College Heights Basins, the RP-3 Recharge Basin, and recharge potential in the Cities of Fontana and Rancho Cucamonga. A summary of the basin improvements for storm water and imported water recharge are presented in Table 4-2. (Specific facilities associated with recharge of recycled water will be identified as part of IEUA's expanded recycled water program.) Table 5-1 summarizes the management zone, storm water and imported water recharge capacity, and capital costs for improvements for each basin.

Table 5-1
Recharge Capacities and Costs for New Basins

Recharge Facility	Mgmt. Zone	Potential Recharge Capacity (acre-ft/yr) (1)									Project Capital Cost
		Storm Water			Imported Water			Recycled Water (2)			
New Basins											
College Heights Basin	1	70	to	100	5,300	to	7,900	70	to	100	$5,625,000
RP-3 Basins	3	1,200	to	1,700	5,800	to	8,600	1,200	to	1,700	$5,595,000
Total	--	1,270	to	1,800	11,100	to	16,500	1,270	to	1,800	$11,220,000

Notes:

(1) Based on optimum recharge operations. Low estimate assumes a recycled water contribution of 20% and the high estimate assumes a recycled water contribution of 50%

(2) It has been assumed that the average annual recharge of recycled water will be the same as storm water. The recycled water recharge capacity is currently under evaluation by IEUA in it's Recycled Water System Feasibility Study.

5.2.1 College Heights Basin

Field investigation of the existing quarries at College Heights revealed that extensive improvements would be required to operate these quarries as spreading basins. The land towards the northwestern section is located directly above a fault and any recharge in this area may not directly benefit Chino Basin. The section of land directly east on the other side of the San Antonio Channel has been filled in with rubbish by surrounding neighbors. The remaining two southern quarries, located on each side of the channel, could be made into groundwater recharge basins. Extensive site work and improvements would be required to get the basins online. The table on the following page presents the cost break down for developing College Heights Basins. The total construction cost is estimated to be about $5,625,000. Table 5-2 provides a breakdown of the costs for improvements. Figure 5-1 illustrates a preliminary facilities layout.

Owner

CBWCD

Location

Upland, California

Recharge Area

22.0 acres

Percolation Rate

2.5 ft./day

Potential Recharge Capacity

Storm Water	70-100 ac-ft/yr
Recycled Water	70-100 ac-ft/yr
Imported Water	5,300-7,900 ac-ft/yr
Total	5,440-8,100 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Diversion Structure at San Antonio Creek
- Outlet Facilities
- Deepen and Optimize Basins for Recharge

Recycled Water

- Pipeline from Montclair 1 Regional Recycled Water Pipeline

Imported Water

- None

Table 5-2
Improvement Costs for College Heights Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Diversion structure at San Antonio Creek (2)	1	ls	$650,000	$650,000
Gated outlet structures (1)	2	ea.	150,000	300,000
Conveyance structure to connect SE basin to Upland Basin (2) (bore & jack under road)	200	ft.	500	100,000
Deepen and optimize basin for recharge (1)	500,000	cy	5	2,500,000
Subtotal Storm Water Recharge				$3,550,000
Recycled Water Recharge				
Pipeline (from Montclair 1 Pipeline) (2)	1,000	ft.	$96	$96,000
Inlet structure (2)	2	ea.	58,000	116,000
Subtotal Recycled Water Recharge				$212,000
Imported Water Recharge				
None				
Total Construction Cost				$3,762,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$4,890,600	$4,891,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	733,590	734,000
Total Capital Cost				**$5,625,000**

Notes:
(1) CBWCD (potential confining layers below surface may increase excavation)
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

5.2.2 RP-3 Recharge Basin

The approximately 60-acre RP-3 site in Management Zone 3 is located north of the Declez Channel, between Live Oak Street and Beach Street. The basin would extend along the existing Declez Channel and be constructed using a balance cut/fill design with an earthen embankment. The RP-3 Basins would be designed for 8 – 5 acre spreading basins in series of four on two parallel lines. The height of the proposed embankment would be approximately 20 feet with a facing side slope of 3:1. The outlet works would convey 20 cfs from the Declez Channel through a new slide gate structure to the basins. In order to import water for recharge, a pump station and pipeline from Jurupa Basin is proposed. The table on the following page presents the costs for developing the RP-3 Recharge Basins. The estimated construction cost is estimated to be about $5,595,000. Table 5-3 provides a breakdown of the costs for improvements. Figure 5-2 illustrates a preliminary layout of the proposed facilities.

Owner

IEUA

Location

Fontana, California

Recharge Area

30 acres

Percolation Rate

1 ft./day

Potential Recharge Capacity

Storm Water	1,200-1,700 ac-ft/yr
Recycled Water	1,200-1,700 ac-ft/yr
Imported Water	5,800-8,600 ac-ft/yr
Total	8,200-12,000 ac-ft/yr

PROPOSED IMPROVEMENTS

Storm Water

- Diversion Structure at Declez Channel
- Clearing and Grubbing
- Deepen and Optimize Basin for Recharge
- Diversion Structures
- Inlet Structures
- Conveyance Structures
- Pipeline from Jurupa Basin
- Pump Station at Jurupa Basin
- Monitoring Wells

Recycled Water

- Pipeline connecting to proposed Regional Recycled Water Pipeline
- Inlet Structure

Imported Water

- New Turnout at Etiwanda Forebay (Share costs with Banana, Declez, Jurupa, and Hickory Basins)
- New 5,000-ft. Pipeline to connect new turnout with Hickory Basins(share costs)

Table 5-3
Improvement Costs for RP-3 Recharge Basin

Description of Work	Quantity	Unit	Unit Cost	Total
Storm Water Recharge				
Channel diversion from Declez Channel (2)	1	ls	$450,000	$450,000
Clearing & Grubbing (2)	1	ls	150,000	150,000
Deepen and optimize basin geometry for recharge (2)	135,000	cy	5	675,000
Division structures (2)	4	ea.	50,000	200,000
Inlet structure (2)	8	ea.	30,000	240,000
Monitoring Wells	1	ea.	300,000	300,000
Conveyance to Spreading Basins	4,000	ft.	144	576,000
Pipeline from Jurupa Basin to RP- 3 (2) (split w/ Declez Basin)	5,000	ft.	96	480,000
Jurupa pump station (2) (split w/ Declez Basin)	1	ls	230,000	115,000
Subtotal Storm Water Recharge				$3,186,000
Recycled Water Recharge				
Inlet structure (2)	1	ls	$58,000	$58,000
Pipeline or lateral from proposed regional line (2)	600	ft.	96	58,000
Subtotal Recycled Water Recharge				$116,000
Imported Water Recharge				
New Turnout (split cost) (2)	0.20	ls	$1,000,000	$200,000
Pipeline from New Turnout (split cost) (2)	1,000	ls	240	240,000
Subtotal Imported Water Recharge				$440,000
Total Construction Cost				$3,742,000
Direct Construction Cost (+ 30% Contingency)	1	ls	$4,864,600	$4,865,000
Indirect Cost (15% of Direct Construction Cost) (3) (4)	1	ls	729,690	730,000
Total Capital Cost				**$5,595,000**

Notes:
(1) CBWCD
(2) B&V
(3) Includes administration, design, and construction management
(4) Values does not include environmental licensing estimate

5.3 Additional Recharge Potential

The preferred area to develop new basins, as found in a preliminary study done by Wildermuth Environmental, is located within the Cities of Fontana and Rancho Cucamonga. Planning and zoning maps were acquired from the City of Fontana to determine if there were any parcels of land adequate for use as recharge basins. These maps indicate that there are no parcels of land of significant size available for recharge basins. Land is either zoned residential/commercial or are allocated for other improvements. Alternative methods of recharge, such as injection wells or on-site recharge, should be considered in order to increase groundwater recharge in this area. Multi-use activities, such as using existing utility corridors for smaller recharge facilities, hiking and biking trails, have not been actively explored but will be in the near future. Such activities could provide additional recharge capabilities.

Although the Cities of Fontana and Rancho Cucamonga are the preferred areas for recharge, other areas of the basin are currently being acquired for this purpose. The CCWD in particular has acquired land for recharge in their service area.

5.4 On-Site Recharge

The recharge opportunities described in Chapter 4 and in Section 5.3 above assume collecting storm water and routing the runoff to storm water channels. This has been the traditional approach to utilizing storm water. However, a less traditional management approach has been receiving attention: capturing and using storm water runoff on site.

On-site recharge was the subject of a recent conference entitled "Beyond BMPs: Integrated Storm Water Management Opportunities for Multiple Benefits in the Chino Basin." The conference was held at the Kellogg West Conference Center, California Polytechnic University, Pomona in July 2001. Concepts explored at the conference included use of state-of-the-art models for routing storm water runoff into on-site landscaping and decorative features. Specific opportunities for construction design in the Chino Basin were also discussed.

Currently, IEUA is working with the Rocky Mountain Institute in developing these innovative management programs for on-sire recharge and other on-site issues, such as constructing a cistern for on-site irrigation. The results of these efforts will be presented in a report issued later this year.

5.5 Injection Wells

Monte Vista Water District (MVWD) is currently conducting a grant-funded feasibility study on the use of injection wells for recharge. Results will be presented at a later date upon completion of the study.

INSERT FIGURES 5-1 THROUGH 5-2

6.0 IMPLEMENTATION PLAN

The Implementation Plan addresses storm water recharge and imported water recharge facilities improvements. To facilitate the improvements, a Chino Basin Recharge Implementation Committee was established. The committee includes representatives from the Watermaster, IEUA, SBCFCD, and CBWCD.

Several institutional arrangements will need to be developed before the proposed improvements are constructed. Currently, CEQA compliance coordination has been initiated for the proposed improvements outlined in this Phase II Report. It is anticipated that CEQA coordination will be completed within the next two months. Long-term operation/maintenance agreements between Watermaster, IEUA, SBCFCD, and CBWCD are also needed to insure maximum operational efficiency.

Design of the improvements will commence with completion of the environmental work and should be completed by April 2002. It is currently planned to design all physical improvements, such as inlets, outlets, monitoring wells, and associated piping. The excavation elements may be excluded from some of the site work to allow the removal of material by third-party contractors, who would pay to remove and sell material from the basins. This approach would be driven by the market needs for material and could extend completion of some work. However, significant cost savings would result.

The length of construction for all of the improvements (except for various excavations using third-party contractors) is estimated to be approximately 14 months. The construction period is somewhat extended because of the need to limit construction activities to between April 15th – October 15th to avoid potential conflict with essential flood control operations.

Continuous monitoring of the facilities will commence upon completion of the construction phase. It is anticipated that the improvements will be constructed by June 30, 2003. The preliminary implementation schedule is presented on Figure 6-1.

Figure 6-1
Preliminary Implementation Schedule